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FINAL REPORT

EVALUATION OF CONSERVATION SYSTEMS: SOILS AND CROPS

PILOT WATERSHED STUDY
(SWEEP)

Prepared for

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EXECUTIVE SUMMARY

EVALUATION OF CONSERVATION SYSTEMS: SOILS AND CROPS PILOT WATERSHED STUDY, SWEEP

1.0 Introduction

The mandate of the Soil and Water Environmental Enhancement Program (SWEEP) was to reduce phosphorus loadings to the Lake Erie basin and to maintain or improve agricultural productivity by reducing or correcting soil erosion and degradation. Conservation cropping and tillage systems were identified as the best means to achieve these goals over such a wide geographic region as the Lake Erie watershed. The Pilot Watershed Study (PWS) was developed as a means of evaluating the impact of conservation systems on soil erosion and degradation, water quality and crop production when implemented on a watershed basis.

The erodibility of soil is a major factor which determines the extent of soil erosion occurring on a landscape. Soil erodibility potential depends on such properties as soil particle size distribution, organic matter content, aggregate stability, bulk density and soil structure. The removal of topsoil by erosion results in changes in these soil properties. The major cause of these changes has been attributed to shifts in land management practices or cultural practices. Prominent among the factors which change soil quality are tillage practices, cropping systems or crop sequences, manure and fertilizer applications and crop residue management. Identifying the components of these systems that improve soil quality has been the focus of numerous research undertakings.

At the watershed level in the PWS the evaluation of conservation systems focused on changes in soil cover. This was the one factor affected by crop production practices that most directly influenced soil erosion control, sediment delivery and ultimately water quality as evidenced by sediment and phosphorus loadings. Target soil cover levels were set in order to provide a tangible and achievable goal for the cooperators to strive for. It was anticipated that these targets, when met, would reduce soil loss on average by at least 50%.

In the PWS the impact of conservation systems on crop production at the farm and field level were left to the cooperators to evaluate in the context of their own operations, their previous experience and their personal production goals. Since the indicators of adoption were strong and favourable it was concluded that during the study, cooperator evaluations of the conservation systems were positive.

For comparative purposes, however, information related to two crop production parameters, use of commercial phosphorus fertilizer and crop yields, is also reported on a watershed basis.

2.0 Methodology

Soil quality monitoring was implemented on a series of soil benchmark sites located within the study watersheds. Using the results of a literature search, a sampling scheme was designed to monitor a broad range of soil properties on an annual basis over the duration of the program. During the spring of 1990, the client directed that the soil monitoring component be expanded to include measurements of seasonal variability in soil physical properties. Of the 38 original soil benchmark sites, 18 were selected (3 in each of the 6 watersheds) for this additional work.

Soil cover within the cropped areas of the watersheds was estimated using either the knotted rope method or a series of assumptions based on previous knowledge or experience. Factors affecting crop production were tracked on a field basis by monitoring cooperator management decisions, weather, soil fertility and crop pests.

3.0 Objectives

The components of the study documented in this report apply specifically to the following PWS objective:

* To determine the nature and degree of changes in relevant soil and water quality parameters and crop yields as influenced by "basin-wide" soil and water conservation practices.

Strategy:

Establish soil, water and crop yield baseline conditions and monitor changes in relevant parameters throughout the life of the program;

Correlate changes in soil, water and crop yield parameters to soil and water conservation practices and systems.

Soil Quality Monitoring Program

The specific objective of the soil quality monitoring component of the PWS was to measure changes in selected soil parameters over the life of the project at benchmark sites in the **test** watershed and to compare these with changes at comparable sites in the **control** watershed. Sites were selected on the principle soils in the watersheds on landscape positions representative of the selected soil types.

The scope of this component was:

1. To assess the effect of conservation farming practices and systems on soil properties which are known to affect crop productivity and/or the magnitude of soil erosion, sediment yield and runoff;

2. To provide soils information needed for comparing crop performance between conservation farming systems and conventional systems and;

3. To provide soils data from refining preliminary estimates of soil loss using the Universal Soil Loss Equation (USLE) and to determine the extent of any changes in the soil related values of parameters in the USLE during the life of the project.

The literature review suggested that improvements would be seen in those soil parameters monitored at the soil benchmark sites managed under conservation systems relative to those managed conventionally.

Crop Monitoring Program

The specific objectives of the crop monitoring program were as follows:

- to determine the proportion of the soil surface covered with live crop or dead crop residue at critical times in the cropping season;
- to monitor pests, soil fertility, weather, and other factors that influence crop performance during the crop production season; and
- to monitor whole plant grain yields of crops.

4.0 Conclusions

- In general there appeared to be more measurable and contrasting change occurring amongst the soil quality parameters in the three test watersheds than in the three control watersheds although the change was not consistent amongst parameters or slope position.

- Uncontrolled differences and/or similarities in tillage and cropping practices between and amongst soil benchmark pairs made it difficult to monitor significant changes in soil quality parameters in the short term (3 years) of the PWS.

- In general the amount of soil cover and area affected increased in the test watersheds during the study and relative to the control watersheds.

- Approximately one half to three quarters of the monitored agricultural areas within the test watersheds that were affected by elevated soil cover levels (20%+) during spring runoff, continued to be affected by soil cover levels greater than 20% after planting (during late May and early June).

- The adoption of conservation systems during the PWS impacted to a greater degree on the soil cover remaining after spring runoff when compared to the soil cover remaining after planting.

- Understanding the influence of the adoption of conservation measures on soil cover within the Pittock watersheds was complicated by the presence of hay-based rotations.

- At the beginning of the PWS the actual application of phosphorus fertilizer on a watershed basis was approximately 1.4 to 3.6 times greater than recommended amounts and at the end of the PWS the actual application of phosphorus fertilizer on a watershed basis fell to approximately .8 to 1.3 times the recommended rates.

- Over application of phosphorus fertilizers can be significantly reduced on a watershed basis if information about soil fertility levels and phosphorus loading of water courses is provided to the producers.

- No difference in crop production potential was detected between each pair of test and control watersheds based on yield data (or any other data) collected during the PWS.

5.0 Recommendations

- In future projects, consideration should be given to holding soil samples, or perhaps splitting each soil sample and holding one of the resulting samples, through the life of the project (or for a suitable timespan) and having all of the samples analyzed by the same laboratory at the same time. This would avoid potential problems with changes in laboratory and analytical techniques that may impact on the study results.

- In short term projects (less than five years) it is critical that paired sites are similar not only in soil character but in soil management as well. Current management practices can influence yearly results and where long term trends are not an objective of the study, short term soil management practices should be similar between pairs and if possible groups of pairs.

- To obtain long term trends of change the monitoring period of soil benchmark sites should be carried out over five years or more. This would allow for the adoption and incorporation of conservation practices as part of the normal farming system.

- The soil benchmark data collected during the PWS could serve as a baseline data set from which future changes in soil quality could be monitored. In the Essex and Kettle watersheds in particular it is likely that the adoption of conservation systems will continue in the future. It is recommended that these soil benchmark sites be monitored every three to five years where adoption of conservation measures has occurred and alternatively where conventional practices have been maintained. This approach should document the long term effects of both systems on soil quality.

- The use of conservation practices should be promoted to sustain increased levels of residue cover on a field or watershed basis.
- Additional clarification regarding the potential contribution of commercial fertilizer to phosphorus loadings should be published.
- Producers should be encouraged to examine their phosphorus fertilizer programs to ensure maximum efficiency.
- The methods and equipment for calibrating fertilizer application rates should be improved.

ACKNOWLEDGEMENTS

The following lists the participating agencies and responsible individuals for components of this study:

Agriculture Canada	Dr. Greg Wall	Technical and Financial Direction
Environment Canada	Mr. Len Camp	Streamflow Monitoring at Watershed Mouths
Ontario Ministry of the Environment	Mr. Jim Eddie	Watershed Scale Water Quality and Meteorological Monitoring
Beak Consultants Limited	Mr. M. Holloran	Project Management
	Mr. R. Walker	Environmental Program Management
Ecologistics Limited	Mr. D. Cressman	Study Process Management
	Ms. J. Sadler Richards	Agronomic Program Management
	Mr. M. Fortin	

1.0 INTRODUCTION

1.1 Background

The Soil and Water Environmental Enhancement Program (SWEEP) was initiated in 1986 with an overall mandate to:

- reduce Ontario's Non-Point Source (NPS) loadings of phosphorus to Lake Erie from agricultural sources by 200 tonnes; and
- maintain or improve the productivity of the primary agricultural sector in Southwestern Ontario by reducing or correcting soil erosion and degradation.

The Pilot Watershed Study (PWS) is a major SWEEP sub-program aimed at evaluating and demonstrating the benefits of established conservation farming systems at the watershed and smaller scales. Figure 1.1 shows the overall SWEEP organizational structure and the PWS sub-program relationship to the Program. Cooperating agencies; Environment Canada (EC), Agriculture Canada (AC), and the Ontario Ministry of the Environment (MOE) are identified. Beak Consultants Limited (BEAK) is the prime contractor responsible to AC and MOE. Ecologistics Limited (ECOLOGISTICS) is a sub-contractor to BEAK responsible for site selection and the agronomic program of the PWS.

The PWS started in 1987 with detailed study design, staffing, training, cooperator enlistment, and watershed selection. Farm plans were initiated in August, 1988 and environmental monitoring began later the same year.

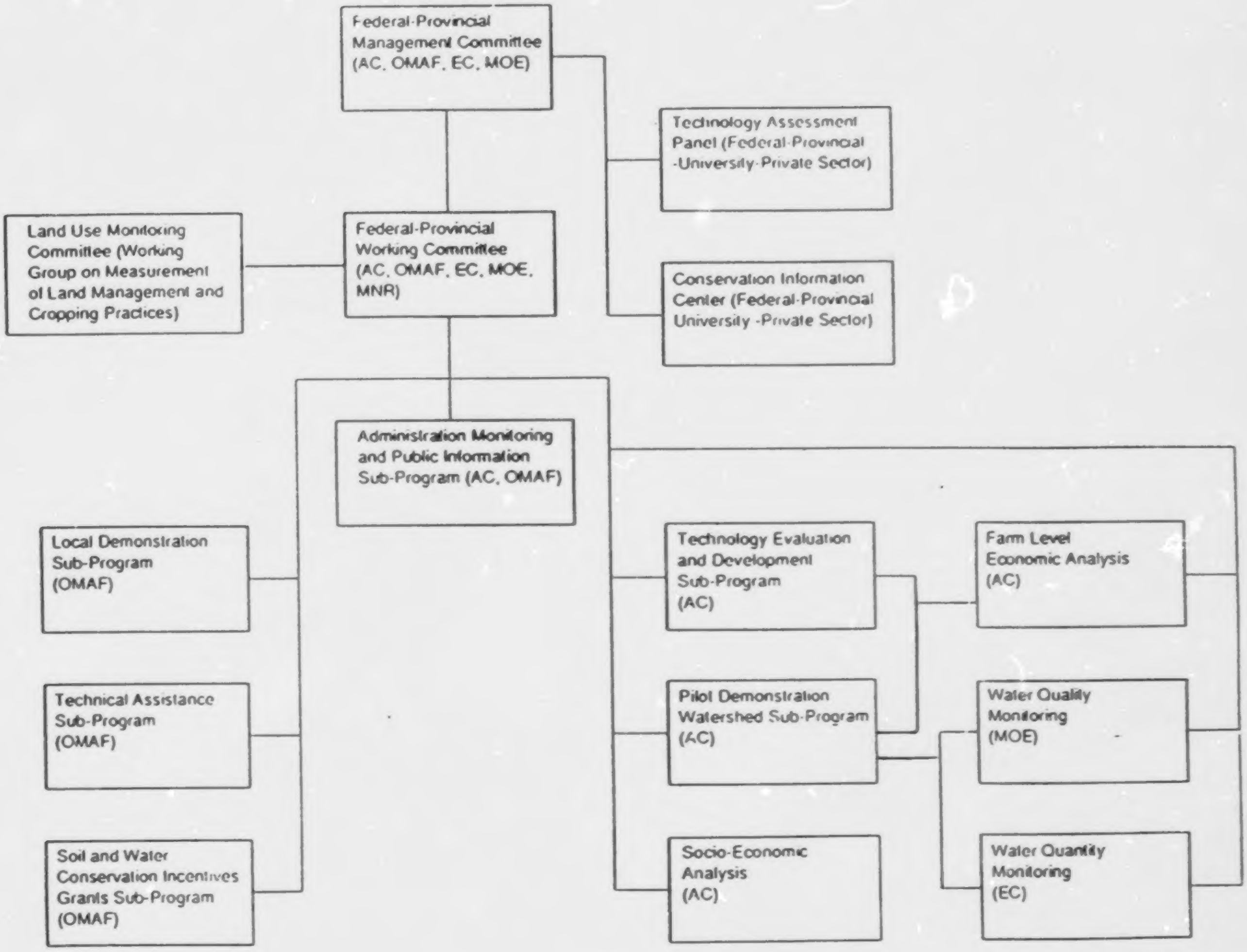
Monitoring and evaluation were conducted from late 1988 until mid 1992.

Figure 1.2 shows the location of PWS subject areas within the Lake Erie Watershed. These are situated within different yet common agricultural and physical settings.

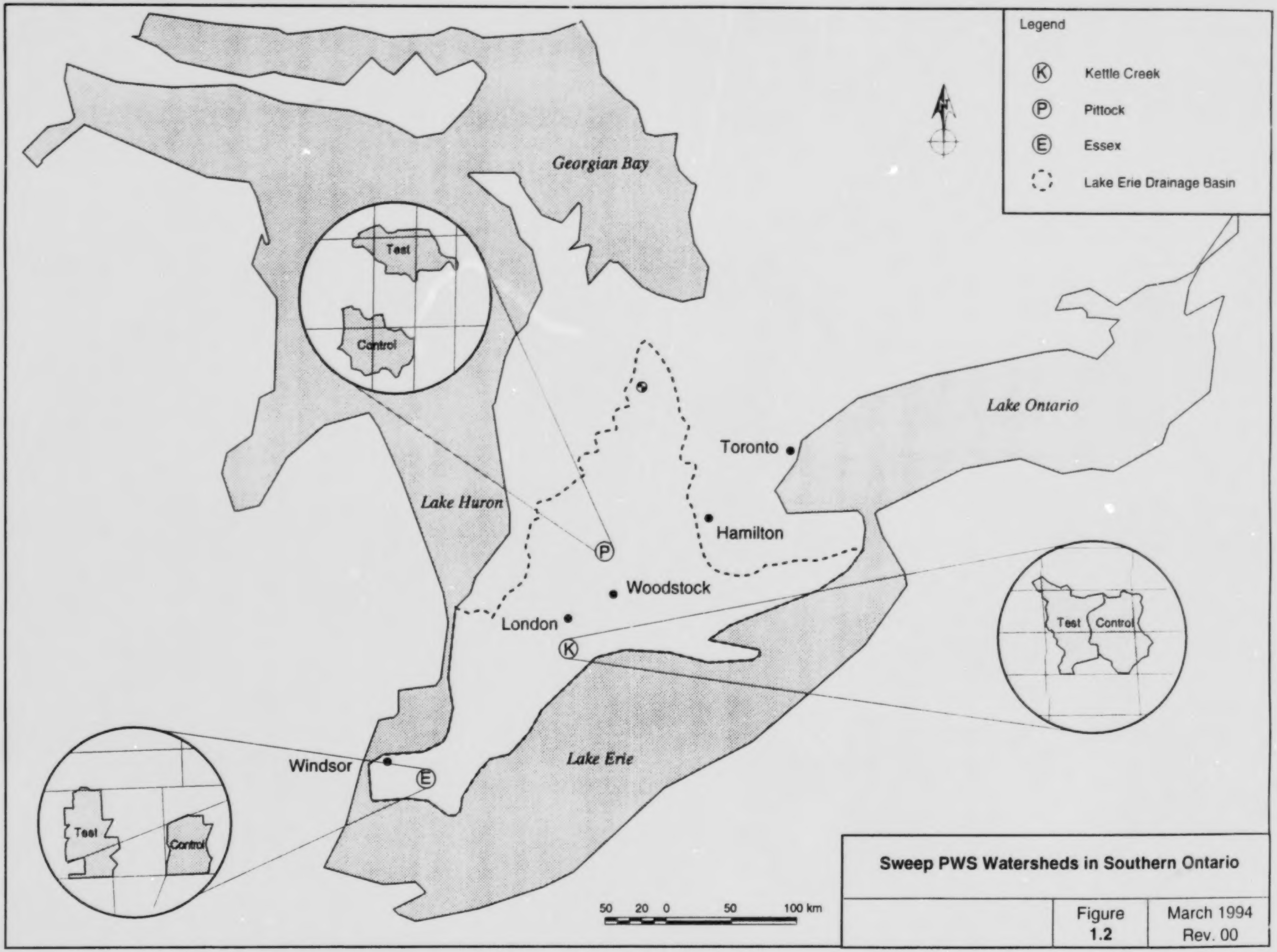
The PWS has the following key features:

- four year implementation and monitoring period;
- **test** (conservation oriented systems) and **control** (conventional systems) paired watershed design;

Figure 1.1: SWEEP Organizational Structure


Federal-Provincial Management Committee (AC, OMAF, EC, MOE)
Technology Assessment Panel (Federal-Provincial -University-Private Sector)
Conservation Information Center (Federal-Provincial University -Private Sector)
Land Use Monitoring Committee (Working Group on Measurement of Land Management and Cropping Practices)
Federal-Provincial Working Committee (AC, OMAF, EC, MOE, MNR)
Administration Monitoring and Public Information Sub-Program (AC, OMAF)
Local Demonstration Sub-Program (OMAF)
Technical Assistance Sub-Program (OMAF)
Soil and Water Conservation Incentives Grants Sub-Program (OMAF)
Technology Evaluation and Development Sub-Program (AC)
Pilot Demonstration Watershed Sub-Program (AC)
Socio-Economic Analysis (AC)
Farm Level Economic Analysis (AC)
Water Quality Monitoring (MOE)
Water Quantity Monitoring (EC)

Abbreviations
AC Agriculture Canada
EC Environment Canada
MNR Ontario Ministry of Natural Resources
MOE Ontario Ministry of the Environment
OMAF Ontario Ministry of Agriculture and Food


Legend
Ⓚ Kettle Creek
Ⓟ Pittock
Ⓔ Essex
Lake Erie Drainage Basin
Georgian Bay
Lake Huron
Lake Ontario
Lake Erie
Toronto
Hamilton
Woodstock
London
Windsor
Test
Control
50 20 0 50 100 km

Sweep PWS Watersheds in Southern Ontario

Figure
1.2

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- pro-active agronomic management involving annual farm planning, cooperator compensation program, ongoing producer extension program, availability of conservation-type farm implements, detailed cooperator record keeping, crop scouting and productivity analysis, and farm level socio-economic evaluation;
- intensive and continuous environmental monitoring at plot, field and watershed scales;
- detailed soil survey and soil quality monitoring;
- extensive environmental monitoring program including meteorology, hydrology and water quality; and
- detailed evaluation involving the application of two modelling systems for farm planning and systems evaluation.

The paired watershed study design is a unique approach which relies upon direct comparisons between the **test** and **control** areas as the primary method of environmental and agronomic evaluation. The effects of scale, at whole watershed, farm, field and plot scales are also a fundamental aspect of the study design which systematically addresses the relationship between producer attitudes and adoption as well as between measurable benefits, complexity, and scale.

1.2 Objectives of the Pilot Watershed Study

Objective Regarding Study/Approach

To achieve a high level of adoption of the most appropriate soil and water conservation practices among farm operators utilizing lands in the **test** sub-watersheds.

Strategy

1. Develop and employ a watershed selection process which:

   a) optimizes the probability of farm operator adoption of desirable practices, and
   b) can be applied effectively to critical areas in the larger Lake Erie basin.

2. Develop and utilize improved soil and water conservation planning tools for application at the farm and watershed levels.

3. Develop and utilize contract arrangements with cooperating farm operators which specify and compensate for participation in the project without "buying" their participation.

Objective Regarding Effectiveness

To determine the nature and degree of changes in relevant soil and water quality parameters and crop yields as influenced by "basin-wide" soil and water conservation practices.

Strategy

1. Select pairs of watersheds which are as similar as possible in respect to physiography, hydrology, and farming systems.

2. Develop and apply mechanisms to encourage adoption of soil and water conservation practices throughout the life of the project in the **test** sub-watersheds and to discourage adoption in the **control** sub-watersheds.

3. Establish soil, water and crop yield baseline conditions and monitor changes in relevant parameters throughout the life of the sub-program.

4. Correlate changes in soil, water and crop yield parameters to soil and water conservation practices and systems.

5. Evaluate improvements to planning tools (models) achieved during the sub-program.

6. Evaluate factors that affect the adoption of soil and water conservation practices and that influence farmer attitudes towards both the practices and the goals of the sub-program.

Objective Regarding Information Dissemination

To prepare information about sub-program activities and results and to transmit this to participating farmers and other related SWEEP sub-programs.

Strategy

1. Collect and transmit, as required, to the SWEEP sub-program contractor responsible for the farm-level and basin-wide economic analysis.

2. Prepare information on activities and results for the communications sub-program contractor.

3. Prepare periodic reports to cooperating farmers on activities and results in written and meeting formats.

1.3 Report Structure

The overall PWS reporting has been sub-divided into the following categories:

- Report #1 - Study Area Selection, Description and Climate;
- Report #2 - Implementation of Conservation Systems;
- Report #3 - Evaluation of Conservation Systems, Social Factors;
- Report #4 - Evaluation of Conservation Systems, Soils and Crops;
- Report #5 - Evaluation of Conservation Systems, Hydrology;
- Report #6 - Evaluation of Conservation Systems, Water Quality;
- Report #7 - Modelling; and
- Report #8 - Executive Summary.

Each report is a stand alone document including a summary, descriptions of objectives, methodologies, observations, discussion, and summarized listings of relevant data where applicable. The Executive Summary is a compilation of summaries from all of the technical reports.

This report documents the modelling activities undertaken as part of the PWS.

1.4 Specific Objectives

The components of the study documented in this report apply specifically to the following PWS objective:

- To determine the nature and degree of changes in relevant soil and water quality parameters and crop yields as influenced by "basin-wide" soil and water conservation practices.

The associated strategies include:

- Establish soil, water and crop yield baseline conditions and monitor changes in relevant parameters throughout the life of the program;

- Correlate changes in soil, water and crop yield parameters to soil and water conservation practices and systems.

2.0 EVALUATING CONSERVATION SYSTEMS IN CONTEXT

As indicated earlier the mandate of SWEEP was to reduce phosphorus loadings to the Lake Erie basin and to maintain or improve agricultural productivity by reducing or correcting soil erosion and degradation. Conservation cropping and tillage systems were identified as the best means to achieve these goals over a wide geographic region such as the Lake Erie watershed. The PWS was developed as a means of evaluating the impact of conservation systems on soil erosion and degradation, water quality and crop production when implemented on a watershed basis.

One of the most commonly used methods for estimating potential soil erosion, and the one used at various stages of the PWS, is the Universal Soil Loss Equation (USLE) developed by Wischmeier and Smith (1978). The USLE is based on the following formula:

$$A = R\ K\ L\ S\ C\ P$$

where

A is the computed soil loss per unit area;
R is the rainfall and runoff factor;
K is the soil erodibility factor;
L is the slope length factor;
S is the slope steepness factor;
C is the cover and management factor; and
P is the support practice factor.

3.0 IMPACT OF CONSERVATION SYSTEMS ON SOIL QUALITY

3.1 Introduction

The erodibility of soil is a major factor which determines the extent of soil erosion occurring on a landscape. Soil erodibility potential depends on such properties as soil particle size distribution, organic matter content, aggregate stability, bulk density and soil structure. The removal of topsoil by erosion results in changes in these soil properties (Greb and Smika, 1983). The major cause of these changes has been attributed to shifts in land management practices or cultural practices (Burwell, et al., 1977; PLUARG, 1978; Richards, 1983). Prominent among these factors which change soil quality are tillage practices, cropping systems or crop sequences, manure and fertilizer applications and crop residue management. Identifying the components of these and systems which improve soil quality has been the focus of numerous research undertakings.

Conservation tillage has been reported to provide beneficial effects to the soil by many authors (Cannel, 1985; Boone et al., 1976; Ellis et al., 1977; Ketcheson and Stonehouse, 1983; Douglas and Goss, 1982; Gebhardt et al., 1985; Blevins et al., 1983; Langdale and Wilson, 1987). Much of this beneficial effect can be attributed to the increased protective residue cover over the soils surface. Ketcheson et al. (1982) reporting on special residue considerations for conservation tillage (mulch tillage, minimum tillage, no-till) stated that as little as 10% residue cover on the soil surface can reduce soil loss to one-tenth of that experienced on the same site with no residue cover. Managing residue at or near the soil surface can also provide a valuable source of organic matter necessary for improving or maintaining stable aggregation in soils as has been demonstrated by many studies (Low, 1972; Oades, 1984; Swarby, 1950; Tisdall and Oades, 1982).

Varying the types of crops and resulting crop residues through crop rotations is beneficial to stable aggregate formation whereas continuous row cropping destroys water stable aggregates through oxidation of organic matter (Low, 1972). More biopores have also been reported under crop rotations than under row cropping (McKeague et al., 1987). Earthworm activity contributes to bioporosity of surface soils and good structure.

Changes in soil organic matter content, soil aggregation and biological activity influences a soils infiltration rate. Roth et al. (1988) in an experiment with surface mulching and tillage systems observed similar infiltration rates under all tillage systems with no mulch but with surface mulching, infiltration rates were higher under no-tillage than under conventional tillage.

Conclusions from research studies such as those mentioned in the preceding paragraphs and others collected at the outset of the PWS through a literature review on the topic (Ecologistics Limited, 1989) were used to identify the soil properties most affected by changes related to conservation management. The following list of affected physical, chemical and biological soil properties was compiled.

Soil texture (spatial variability due to erosion)
Aggregate stability
Infiltration rates
Bulk density
Air porosity
Field soil moisture content
Available moisture-holding capacity
Permeability
Plasticity index
Soil temperature
Organic carbon
Nitrogen (total N)
Available phosphorus(P)
Exchangeable calcium (Ca), magnesium (Mg) and potassium (K)
pH
Calcium carbonate ($CaCO_3$) equivalent
Cation exchange capacity (CEC)
Biological activity
Particle size distribution (calgon and/or water dispersed)

It was noted that not all of the soil characteristics mentioned above would show detectable changes within the duration of the PWS. It was therefore necessary to select those properties which would likely show some change under conservation management within the period of study. Similarly, several methods existed for measuring each property. However, the final choice of a particular method depended on its suitability under prevailing field conditions, availability of equipment, cost, accuracy, timeliness and ease of operation and its ability to meet the objectives of the soil quality monitoring work.

3.2 Objectives

The objective of the soil quality monitoring component of the PWS was to measure changes in selected soil parameters over the life of the project at benchmark sites in the **test** watershed and to compare these with changes at comparable sites in the **control** watershed. Sites were selected on the principle soils in the watersheds on landscape positions representative of the selected soil types.

The scope of this component was:

1. To assess the effect of conservation farming practices and systems on soil properties which are known to affect crop productivity and/or the magnitude of soil erosion, sediment yield and runoff;

2. To provide soils information needed for comparing crop performance between conservation farming systems and conventional systems and;

3. To provide soils data from refining preliminary estimates of soil loss using the USLE and to determine the extent of any changes in the soil related values of parameters in the USLE during the life of the project.

The literature review suggested that improvements would be seen in those soil parameters monitored at the soil benchmark sites managed under conservation systems relative to those managed conventionally (Ecologistics Limited, 1989).

3.3 Materials and Methods

3.3.1 Selection of Benchmark Sites

Soil quality monitoring was implemented on a series of soil benchmark sites located within the study watersheds. The goal of the benchmark site selection process was to find soil landscapes that were as similar as possible between the **test** and **control** watershed pairs, where there were reasonable grounds for expecting that the **test** cooperator would initiate conservation measures in the field(s) containing the sites and where the cooperator would accept the monitoring activity. The benchmark sites included the predominant soils of the basin important for agriculture.

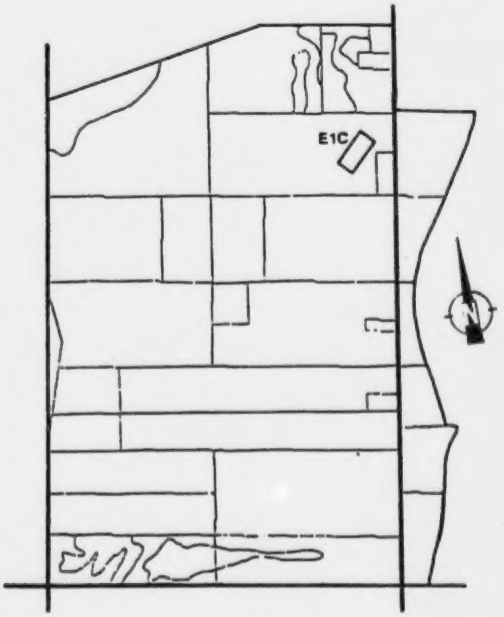
Where conditions permitted, the catenary transect selected was situated within the watershed, where slopes were maximized and where projected tillage and cropping practices were most likely to produce measurable changes in soil properties within the monitoring period. The benchmark transect selected in each field represented a topo-sequence, and, where possible, included shoulder slope, middle slope and toe slope positions. These transects included soils at various stages of erosion and deposition.

Candidate benchmark sites were selected in the winter of 1988/1989 using the detailed soils mapping information prepared by Ecological Services for Planning Ltd. (ESP, 1990). The final benchmark sites chosen were positioned on the key landscape positions (shoulder slope, middle slope and toe slope). Figures 3.1 through 3.3 identify the general location of the benchmark sites in each pair of watersheds. **Test** basin benchmarks were paired to benchmarks on corresponding landscape positions in the **control** basin within each watershed.

Precise locations of benchmarks were identified by scanning prospective soils landscapes with an electromagnetic induction meter (Geonics model EM38). By scanning along the slope contour, the influences of soil moisture content on the instrument reading was minimized (Kachanoski et al., 1988) and an impression of lithological consistency of soil parent material was obtained. Once the distribution of the parent material was delineated, scanning perpendicular to the slope contour gave an impression of the catenary distribution with slope position (i.e. groundwater table position and internal

Figure 3.1 Soil Benchmark Monitoring Site Locations (Essex)

Essex Control



Essex Test

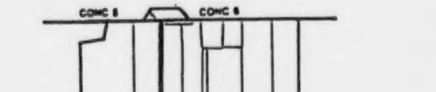
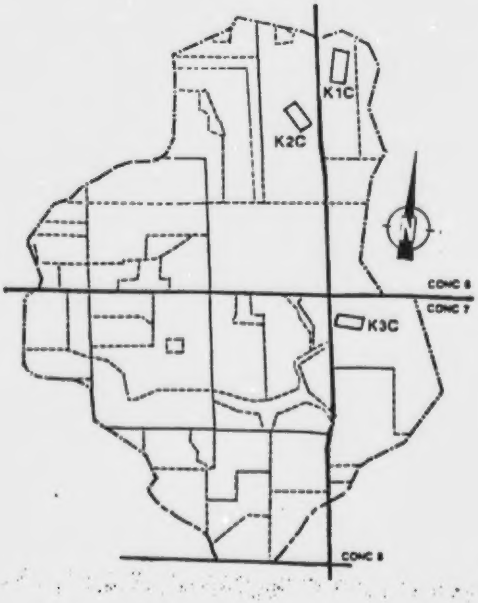

CONC 8
CONC 8
E1T
N

Figure 3.2 Soil Benchmark Monitoring Site Locations (Kettle)

Kettle Control


K1C
K2C
N
CONC 6
CONC 7
K3C
CONC 8

Kettle Test

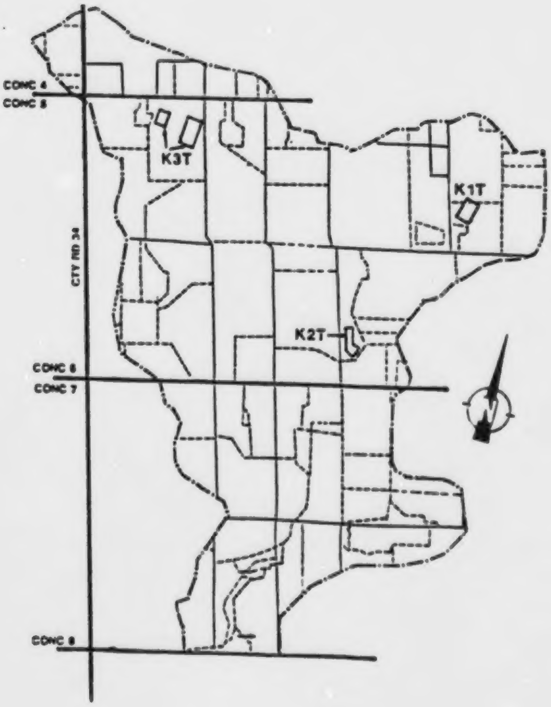
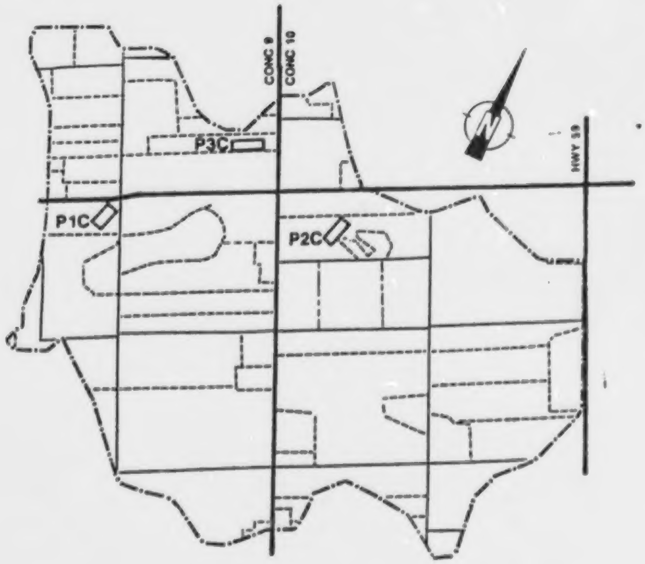
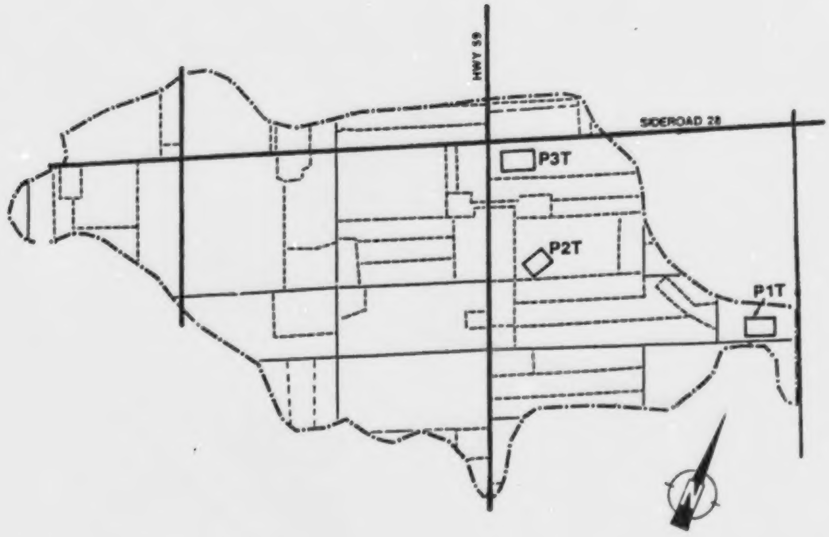

CONC 4
CONC 5
K3T
K1T
CTY RD 34
K2T
CONC 6
CONC 7
N
CONC 8

Figure 3.3 Soil Benchmark Monitoring Site Locations (Pittock)

Pittock Control


CONC 9
CONC 10
HWY 59
P3C
P1C
P2C

Pittock Test


HWY 59
SIDEROAD 28
P3T
P2T
P1T

drainage class). The final suitability of preferred benchmark locations was confirmed by a soil auger profile inspection.

The absolute magnitude of the instrument readings also provided an indication of the nutrient status (i.e. solute concentration) of the soil to ensure that past cropping history had sustained a level of soil productivity consistent with the particular series or catena (McBride, 1989).

Drainage flag markers were used to delineate an area of 1 m^2 as the benchmark site. ESP later confirmed the site locations and plotted them on maps with landmark references. An electromagnetic marker was buried below the depth of tillage to permanently mark the site. Seven pairs of soil benchmark sites (Essex-1; Kettle-3; Pittock-3) were selected and established within the watersheds. Each pair consisted of one test and one control site with two to four slope positions identified and monitored per site. In all, 38 permanent soil benchmark points were included in the PWS.

3.3.2 Soil Parameters Monitored

Using the results of the literature search, a sampling scheme was designed to monitor a broad range of soil properties on an annual basis over the duration of the program (Ecologistics Limited, 1989). During the spring of 1990, the client directed that the soil monitoring component be expanded to include measurements of seasonal variability in soil physical properties. Of the 38 original soil benchmark sites, 18 were selected (3 in each of the 6 watersheds) for this additional work.

Table 3.1 outlines the schedule of the benchmark soil sampling along with the soil parameters measured and the sampling techniques and analytical methodologies utilized. A detailed description of the field techniques used to enable consistent and uniform collection of the soil samples is given in Appendix A.

Table 3.1. Soil Benchmark Sampling Schedule, Soil Measurements, Sampling Techniques and Analytical Methodologies

Soil Property (Sampling/Analytical Method)	Seasonal Measurements*			Annual Measurements*
	Spring (pre-plant)	Late Spring (post-plant)	Fall** (post-harvest)	Fall** (post harvest)
Particle Size Distribution (Calgon Dispersed)				X
Particle Size Distribution (Water Dispersed)	X	X	X	
Wet Aggregate Stability (Pojasok and Kay, 1990)				X
Plasticity Index (Atterberg Limits, McBride et al, 1990)				X
Available Moisture Holding Capacity (McBride and Mackintosh, 1984)				X
Cation Exchange Capacity (Rhoades, 1982)				X
Bulk Density Ring Method (Blake and Hartge, 1986)				X
Organic Carbon (Walkley and Black, 1934)				X
Available P (ASTM Standards)				X
Exchangeable Ca, Mg & K (ASTM Standards)				X
Soil pH (ASTM Standards)				X
$CaCO_3$ (ASTM Standards)				X
Biological Activity Index (Vance et al, 1987)	X	X	X	
Wet Bulk Density (CPN Portaprobe)	X	X	X	X
Field Soil Moisture Content (CPN Portaprobe)	X	X	X	X
Infiltration Rate (GPI)	X	X	X	X
Crop Yield (Hand Harvest)			X	X
Soil Surface Residue Cover (Line-transect)	X	X	X	

* Seasonal measurements included 18 sites; annual measurements included 38 sites.

** Fall seasonal and annual measurements were combined into one sampling trip if possible.

Abbreviations:
ASTM American Society of Testing and Materials
CPN Campbell Pacific Nuclear
GPI Guelph Pressure Infiltrometer

3.3.2.1 Soil Properties Monitored Annually

Soil property annual measurements were taken in the fall of each year following harvest, prior to any fall primary tillage. The measured parameters were divided into two categories depending on the way the data were collected:

- those measured in-situ using specialized equipment, and
- those requiring soil samples and subsequent laboratory analysis.

i) Characteristics measured in-situ were:

1. Infiltration rates
2. Field soil moisture content Portaprobe.
3. Field wet bulk density

ii) Characteristics determined by sampling and laboratory analysis were:

Physical Analyses:

1. Bulk density (0 - 15 cm and 15 - 30 cm).
2. Wet aggregate stability (0 - 15 cm).
3. Plasticity index (0 - 15 cm and 15 - 30 cm).
4. Available moisture holding capacity (alternate years).
5. Particle size distribution.
6. Crop yield.

Chemical Analyses:

1. Organic carbon (0 - 15 cm).
2. Available P (0 - 15 cm).
3. Exchangeable Ca, Mg and K (0 - 15 cm).
4. Soil pH (0 - 15 cm).
5. $CaCO_3$ equivalent (0 - 15 cm).
6. Cation exchange capacity (C.E.C) (0 - 15 cm).

3.3.2.2 Soil Properties Monitored Seasonally

Selection of the 18 seasonally monitored benchmark sites was based on:

- predominant soil catenas of the watershed,
- slope characteristics,
- degree of uniformity between test and control watersheds, and
- cooperation of the landowner.

At each of these more intensively monitored sites, several alternative sampling and analytical procedures were employed in order to collect temporal variability data (Wall et al., 1991). Table 3.1 indicates the specific parameters monitored temporally and the sampling and analytical methods employed.

The temporal sampling periods on the 18 benchmark sites were as follows:

- winter (thaw, pre-plant),
- spring (post plant), and
- fall (post harvest).

Winter sampling occurred during a significant thaw period from January to May. Spring sampling measurements were completed during the post plant period of late May and June. The fall sampling occurred during the post harvest period and coincided with the annual benchmark sampling at the 38 benchmark sites. Thus, fall seasonal and annual measurements were taken at the same time where possible.

3.3.3 Management of Soil Benchmark Sites

To assist in the analysis of soil benchmark site data, the cropping and tillage patterns were documented at each site during the study period. Table 3.2 summarizes this management information as well as the soil type and sampling frequency associated with each benchmark. Note that with progression of the PWS, the level of conservation tillage on the test watershed benchmarks tended to increase to varying degrees as cooperators became more comfortable with new management techniques.

Table 3.2. Soil Benchmark Site, Soil, Crop and Primary Tillage Summary

Site (Field No.)	Soil Series	Sampling Frequency	Cropping Period							
			1988/89		1989/90		1990/91		1991/92*	
			Primary Tillage	Crop Grown	Primary Tillage	Crop Grown	Primary Tillage	Crop Grown	Primary Tillage	Crop Grown
K1T1 (216-1)	Muriel	Seasonal/ Annual	Fall Chisel Plough	Soybeans	Spring Cultivate	Soybeans	No-Till	Grain corn	No-till	Soybeans
K1T2 (216-1)	Gobles	Seasonal/ Annual	Fall Chisel Plough	Soybeans	Spring Cultivate	Soybeans	No-Till	Grain corn	No-till	Soybeans
K1T3 (216-1)	Kelvin	Seasonal/ Annual	Fall Chisel Plough	Soybeans	Spring Cultivate	Soybeans	No-Till	Grain corn	No-till	Soybeans
K2T1 (218-2)	Gobles	Annual	Fall Modified Moldboard	Soybeans	No-Till	Winter wheat	No-Till	Grain corn		
K2T2 (218-2)	Gobles	Annual	Fall Modified Moldboard	Soybeans	No-Till	Winter wheat	No-Till	Grain corn		
K2T3 (218-2)	Kelvin	Annual	Fall Modified Moldboard	Soybeans	No-Till	Winter wheat	No-Till	Grain corn		
K3T1 (210-3)	Gobles	Annual	Fall Moldboard	Sweet corn	Fall Chisel Plough	Soybeans	No-Till	Grain corn		
K3T2 (210-3)	Kelvin	Annual	Fall Moldboard	Sweet corn	Fall Chisel Plough	Soybeans	No-Till	Grain corn		
K3T1A (210-3)	Gobles	Annual	Fall Moldboard	Sweet corn	Fall Chisel Plough	Soybeans	No-Till	Grain corn		
K1C1 (203-1)	Muriel	Seasonal/ Annual	Fall Moldboard	Grain corn	Fall Moldboard	Grain corn	Fall Moldboard	Soybeans	Fall Cultivate	Winter wheat (underseeded)
K1C2 (203-1)	Gobles	Seasonal/ Annual	Fall Moldboard	Grain corn	Fall Moldboard	Grain corn	Fall Moldboard	Soybeans	Fall Cultivate	Winter wheat (underseeded)
K1C3 (203-1)	Kelvin	Seasonal/ Annual	Fall Moldboard	Grain corn	Fall Moldboard	Grain corn	Fall Moldboard	Soybeans	Fall Cultivate	Winter wheat (underseeded)
K2C1 (205-1)	Muriel	Annual	Fall Cultivate	Winter wheat	Fall Moldboard	Grain corn	Fall Moldboard	Grain corn		
K2C2 (205-1)	Gobles	Annual	Fall Cultivate	Winter wheat	Fall Moldboard	Grain corn	Fall Moldboard	Grain corn		
K2C3 (205-1)	Kelvin	Annual	Fall Cultivate	Winter wheat	Fall Moldboard	Grain corn	Fall Moldboard	Grain corn		

Table 3.2 Soil Benchmark Site, Soil, Crop and Primary Tillage Summary (continued).

Site (Field No.)	Soil Series	Sampling Frequency	Cropping Period							
			1988/89		1989/90		1990/91		1991/92*	
			Primary Tillage	Crop Grown	Primary Tillage	Crop Grown	Primary Tillage	Crop Grown	Primary Tillage	Crop Grown
K3C1 (204-1)	Gobles	Annual	Spring Moldboard	Grain corn	Fall Moldboard	Soybeans	Spring Moldboard	Sweet corn		
K3C2 (204-1)	Kelvin	Annual	Spring Moldboard	Grain corn	Fall Moldboard	Soybeans	Spring Moldboard	Sweet corn		
P1T1 (314-3)	Honeywood	Seasonal/ Annual	Fall Adjusted Moldboard	Grain corn	Fall Modified Moldboard	Grain corn	Spring Modified Moldboard	Grain corn	Fall Modified Moldboard	Grain corn
P1T2 (314-3)	Honeywood	Seasonal/ Annual	Fall Adjusted Moldboard	Grain corn	Fall Modified Moldboard	Grain corn	Spring Modified Moldboard	Grain corn	Fall Modified Moldboard	Grain corn
P1T3 (314-3)	Crombie	Seasonal/ Annual	Fall Adjusted Moldboard	Grain corn	Fall Modified Moldboard	Grain corn	Spring Modified Moldboard	Grain corn	Fall Modified Moldboard	Grain corn
P1T3A (314-3)	Colwood	Annual	Fall Adjusted Moldboard	Grain corn	Fall Modified Moldboard	Grain corn	Spring Modified Moldboard	Grain corn		
P2T1 (315-4)	Honeywood	Annual	Fall Moldboard	Grain corn	Fall Moldboard	Grain corn	Fall Modified Moldboard	Soybeans		
P2T2 (315-4)	Embro	Annual	Fall Moldboard	Grain corn	Fall Moldboard	Grain corn	Fall Modified Moldboard	Soybeans		
P3T1 (315-1)	Honeywood	Annual	Fall Chisel Plough	Winter wheat	Fall Moldboard	Grain corn	Fall Modified Moldboard	Grain corn		
P3T2 (315-1)	Honeywood	Annual	Fall Chisel Plough	Winter wheat	Fall Moldboard	Grain corn	Fall Modified Moldboard	Grain corn		
P1C1 (302-1)	Honeywood	Seasonal/ Annual	Spring Moldboard	White beans	No-Till	Winter wheat	Fall Moldboard	Cranberry beans	Fall Moldboard	Grain corn
P1C2 (302-1)	Embro	Seasonal/ Annual	Spring Moldboard	White beans	No-Till	Winter wheat	Fall Moldboard	Cranberry beans	Fall Moldboard	Grain corn
P1C3 (302-1)	Embro	Seasonal/ Annual	Spring Moldboard	White beans	No-Till	Winter wheat	Fall Moldboard	Cranberry beans	Fall Moldboard	Grain corn
P2C1 (303-3)	Honeywood	Annual	Spring Moldboard	Grain corn	Fall Moldboard	Kidney beans	Spring Moldboard	Grain corn		

Table 3.2 Soil Benchmark Site, Soil, Crop and Primary Tillage Summary (continued).

Site (Field No.)	Soil Series	Sampling Frequency	Cropping Period							
			1988/89		1989/90		1990/91		1991/92*	
			Primary Tillage	Crop Grown	Primary Tillage	Crop Grown	Primary Tillage	Crop Grown	Primary Tillage	Crop Grown
P2C2 (303-3)	Embro	Annual	Spring Moldboard	Grain corn	Fall Moldboard	Kidney beans	Spring Moldboard	Grain corn		
P3C1 (311-3)	Honeywood	Annual	Fall Moldboard	Grain corn (underseeded)	Spring Moldboard	Grain corn (under-seeded)	Spring Disk/ Moldboard	Soybeans		
P3C2 (311-3)	Honeywood	Annual	Fall Moldboard	Grain corn (underseeded)	Spring Moldboard	Grain corn (under-seeded)	Spring Disk/ Moldboard	Soybeans		
E1T1 (116-2)	Brookston (poorly drained)	Seasonal/ Annual	Fall Chisel Plow	Soybeans	Fall Cultivate	Winter wheat	Fall Cultivate	Soybeans	Fall Cultivate	Soybeans
E1T2 (116-2)	Brookston	Seasonal/ Annual	Fall Chisel Plow	Soybeans	Fall Cultivate	Winter wheat	Fall Cultivate	Soybeans	Fall Cultivate	Soybeans
E1T3 (116-2)	Brookston	Seasonal/ Annual	Fall Chisel Plow	Soybeans	Fall Cultivate	Winter wheat	Fall Cultivate	Soybeans	Fall Cultivate	Soybeans
E1C1 (103-3/ 131-1)**	Brookston	Seasonal/ Annual	Fall Moldboard	Soybeans	Fall Cultivate	Winter wheat	Fall Moldboard	Grain corn	Fall Moldboard	Grain corn
E1C2 (103-3/ 131-1)**	Brookston	Seasonal/ Annual	Fall Moldboard	Soybeans	Fall Cultivate	Winter wheat	Fall Moldboard	Grain corn	Fall Moldboard	Grain corn
E1C3 (103-3/ 131-1)**	Brookston	Seasonal/ Annual	Fall Moldboard	Soybeans	Fall Cultivate	Winter Wheat	Fall Moldboard	Grain corn	Fall Moldboard	Grain corn

* 1991/92 Crop and tillage information provided for seasonally monitored sites only.

** Ownership changed in summer 1990, therefore Site (Field No.) changed.

Site Key: abcd=K1T1

a:	K=Kettle; P=Pittock; E=Essex
b:	1=site 1; 2=site 2; 3=site 3
c:	T=test; C=control
d:	1=top slope position; 2=middle slope position; 3=bottom slope position

3.4 Results and Discussion

The main objective of the soil quality monitoring component of the PWS was to measure changes in selected soil parameters over the life of the project at benchmark sites in the test and control watersheds. The achievement of this objective was based on the premise that comparable monitoring sites could be found and maintained, that significant differences in tillage and cropping patterns would exist between the test and control sites and that these differences would be manifested by seasonal and/or annual changes in the soil parameters that were monitored.

Early in the project it was determined that a *laissez faire* approach regarding the planned and actual tillage and cropping practices used in those fields where soil benchmark sites were located was appropriate. The reason for this lay in the objectives of the PWS where a watershed level (test vs control) and not a field level of analysis was of primary importance. The "artificial" manipulation of the sites was not within the mandate of the study. As a result of this approach however many benchmark pairs had similar tillage practices but different crops each year at each site. Neither of these occurrences were helpful when the results of the monitoring program were examined for short term shifts or trends in soil quality parameters between the test and control watersheds. For example soil residue cover and crop yield were not compared between watershed soil benchmark sites due to differences in previous and current crop type respectively.

The soil quality parameters monitored during the PWS all affect soil erodibility either directly or indirectly. Within the USLE however K or soil erodibility is decreased if the silt and very fine sand component of the soil is decreased, if soil organic matter content increases, if soil structure decreases (goes from blocky to granular) and/or if soil permeability increases. The effects of management changes in the test watershed relative to the control watershed on these parameters were of particular interest as indicators of potential effect on soil erosion.

As stated earlier seven pairs of soil benchmark sites were monitored during the PWS. Appendix B contains all the available raw data for each soil parameter monitored at each of the soil benchmark sites and slope positions.

In the Essex test and control watersheds differences in tillage and crop management did occur at the soil benchmark sites (see Table 3.2). As indicated in Table 3.3 in the Essex test watershed these changes in management resulted in a significant increase in soil organic carbon content and soil plasticity index (15-30cm depth) during the life of the PWS. Similar changes did not occur in the control watershed. The soil pH however did appear to significantly decrease however during the project in the control watershed whereas there was no change in the test watershed. In addition to this it is apparent that the level topography also resulted in essentially no identifiable trends or shifts in soil quality parameters between slope positions either within or between sites (Table 3.6) although a significant decrease in exchangeable K was documented at the middle slope position in the test watershed.

In the Pittock test and control watersheds the differences in tillage and crop management between paired sites (see Table 3.2) also appeared to cause little change in soil quality parameters during the project. In the test watershed infiltration rate increased on a seasonal basis relative to the control watershed which showed no significant change in infiltration rate. Field soil moisture content, which is very dependant on weather from year to year, also appeared to significantly decrease in the test watershed through the years relative to the control watershed. In contrast particle size distribution as indicated by the silt and very fine sand component significantly increased in the control watershed during the project (data suspect due to dramatic change between year one and two) as did pH (Table 3.4). The explanation for the general lack of measurable change in most soil parameters is not clear but it is anticipated that the differences in primary tillage were not great enough to cause shifts within a relatively short time span of three years. The topography in this pair of watersheds was much more variable than in the Essex watersheds and the top and bottom slope positions were well defined. The test watershed did generally show more change than the control watershed with the bottom slope position being most affected. In all, six soil quality parameters were affected including water aggregate stability, near surface soil bulk density, exchangeable Mg, soil pH, field soil moisture content and infiltration rate. In contrast in the control watershed exchangeable K and infiltration rate changed at the middle and top slope positions respectively (Table 3.7).

In the Kettle test watershed infiltration rate increased and exchangeable K and Mg decreased significantly during the life of the PWS. In contrast infiltration rate in the

Table 3.3. Essex Soil Benchmark Sites - Results of Statistical Analysis[1] for Annual and Seasonal Data

Soil Property	Annual Measurements per Watershed		Seasonal Measurements per Watershed	
	Test	Control	Test	Control
Particle Size Distribution as Indicated by the Silt and Very Fine Sand Fraction (Calgon Dispersed)	NS	NS	-	-
Particle Size Distribution as Indicated by the Silt and Very Fine Sand Fraction (Water Dispersed)	-	-	NS	NS
Wet Aggregate Stability	**	*	-	-
Plasticity Index (0-15 cm)	NS	NS	-	-
Plasticity Index (15-30 cm)	*	NS	-	-
Available Moisture Holding Capacity (0-15 cm)	NA	NA	-	-
Available Moisture Holding Capacity (15-30 cm)	NA	NA	-	-
Cation Exchange Capacity	NS	NS	-	-
Bulk Density Ring Method (0-15 cm)	NS	NS	-	-
Bulk Density Ring Method (15-30 cm)	NS	NS	-	-
Organic Carbon	*	NS	-	-
Available P	NS	NS	-	-
Exchangeable K	NS	NS	-	-
Exchangeable Mg	NS	NS	-	-
Exchangeable Ca	NA	NA	-	-
Soil pH	NS	*	-	-
$CaCO_3$	*	*	-	-
Biological Activity Index	-	-	NS	NS
Wet Bulk Density	NS	NS	**	**
Field Soil Moisture Content	**	**	NS	NS
Infiltration Rate	NS	NS	NS	NS

Note:

NS	not significant at the $p < .05$ level of probability
*	significant at the $p < .05$ level of probability
**	significant at the $p < .01$ level of probability
-	data not taken for soil parameter
NA	not applicable, only 2 years of data available

---

[1] Linear regression of soil property on time.

Table 3.4. Pittock Soil Benchmark Sites - Results of Statistical Analysis[1] for Annual and Seasonal Data

Soil Property	Annual Measurements per Watershed		Seasonal Measurements per Watershed	
	Test	Control	Test	Control
Particle Size Distribution as Indicated by the Silt and Very Fine Sand Fraction (Calgon Dispersed)	NS	NS	-	-
Particle Size Distribution as Indicated by the Silt and Very Fine Sand Fraction (Water Dispersed)	-	-	NS	**
Wet Aggregate Stability	NS	NS	-	-
Plasticity Index (0-15 cm)	NS	NS	-	-
Plasticity Index (15-30 cm)	NS	NS	-	-
Available Moisture Holding Capacity (0-15 cm)	NA	NA	-	-
Available Moisture Holding Capacity (15-30 cm)	NA	NA	-	-
Cation Exchange Capacity	NS	NS	-	-
Bulk Density Ring Method (0-15 cm)	NS	NS	-	-
Bulk Density Ring Method (15-30 cm)	NS	NS	-	-
Organic Carbon	NS	NS	-	-
Available P	NS	NS	-	-
Exchangeable K	**	**	-	-
Exchangeable Mg	**	**	-	-
Exchangeable Ca	NA	NA	-	-
Soil pH	NS	*	-	-
$CaCO_3$	**	*	-	-
Biological Activity Index	-	-	NS	NS
Wet Bulk Density	NS	NS	*	**
Field Soil Moisture Content	**	NS	NS	NS
Infiltration Rate	**	**	*	NS

Note:		
	NS	not significant at the $p < .05$ level of probability
	*	significant at the $p < .05$ level of probability
	**	significant at the $p < .01$ level of probability
	-	data not taken for soil parameter
	NA	not applicable, only 2 years of data available

---

[1] Linear regression of soil property on time.

Table 3.5. Kettle Soil Benchmark Sites - Results of Statistical Analysis[1] for Annual and Seasonal Data

Soil Property	Annual Measurements per Watershed		Seasonal Measurements per Watershed	
	Test	Control	Test	Control
Particle Size Distribution as Indicated by the Silt and Very Fine Sand Fraction (Calgon Dispersed)	NS	NS	-	-
Particle Size Distribution as Indicated by the Silt and Very Fine Sand Fraction (Water Dispersed)	-	-	NS	NS
Wet Aggregate Stability	NS	*	-	-
Plasticity Index (0-15 cm)	NS	NS	-	-
Plasticity Index (15-30 cm)	NS	NS	-	-
Available Moisture Holding Capacity (0-15 cm)	NA	NA	-	-
Available Moisture Holding Capacity (15-30 cm)	NA	NA	-	-
Cation Exchange Capacity	NS	*	-	-
Bulk Density Ring Method (0-15 cm)	NS	NS	-	-
Bulk Density Ring Method (15-30 cm)	NS	NS	-	-
Organic Carbon	NS	NS	-	-
Available P	NS	NS	-	-
Exchangeable K	**	NS	-	-
Exchangeable Mg	**	NS	-	-
Exchangeable Ca	NA	NA	-	-
Soil pH	NS	NS	-	-
$CaCO_3$	NS	NS	-	-
Biological Activity Index	-	-	NS	NS
Wet Bulk Density	NS	NS	*	**
Field Soil Moisture Content	**	**	*	**
Infiltration Rate	*	NS	NS	*

Note:

Note:	NS	not significant at the $p < .05$ level of probability
	*	significant at the $p < .05$ level of probability
	**	significant at the $p < .01$ level of probability
	-	data not taken for soil parameter
	NA	not applicable, only 2 years of data available

---

[1] Linear regression of soil property on time.

Table 3.6. Essex Soil Benchmark Sites - Results of Statistical Analysis[1] for Annual Data Based on Slope Position

Soil Property	Test			Control		
	Top	Middle	Bottom	Top	Middle	Bottom
Particle Size Distribution as Indicated by the Silt and Very Fine Sand Fraction (Calgon Dispersed)	NS	NS	NS	NS	NA	NS
Particle Size Distribution as Indicated by the Silt and Very Fine Sand Fraction (Water Dispersed)	-	-	-	-	-	-
Wet Aggregate Stability	NS	NS	NS	NS	NA	NS
Plasticity Index (0-15 cm)	NS	NA	NS	NS	NA	NS
Plasticity Index (15-30 cm)	NS	NA	NS	NS	NA	NS
Available Moisture Holding Capacity (0-15 cm)	NA	NA	NA	NA	NA	NA
Available Moisture Holding Capacity (15-30 cm)	NA	NA	NA	NA	NA	NA
Cation Exchange Capacity	NS	NS	NS	NS	NA	NS
Bulk Density Ring Method (0-15 cm)	NS	NS	NS	NS	NA	NS
Bulk Density Ring Method (15-30 cm)	**	NS	NS	**	NA	NS
Organic Carbon	NS	NS	NS	NS	NA	NS
Available P	NS	NS	NS	NS	NA	NS
Exchangeable K	NS	**	NS	NS	NA	NS
Exchangeable Mg	NS	NS	NS	NS	NA	NS
Exchangeable Ca	NA	NA	NA	NA	NA	NA
Soil pH	NS	NS	NS	NS	NA	NS
$CaCO_3$	NS	NS	NS	NS	NA	NS
Biological Activity Index	-	-	-	-	-	-
Wet Bulk Density	NS	NS	NS	NS	NA	NS
Field Soil Moisture Content	NS	NS	NS	NS	NA	NS
Infiltration Rate	NS	NS	NS	NS	NA	NS

Note:		
	NS	not significant at the $p < .05$ level of probability
	*	significant at the $p < .05$ level of probability
	**	significant at the $p < .01$ level of probability
	-	data not taken for soil parameter
	NA	not applicable, only 2 years of data available

---

[1] Linear regression of soil property on time.

Table 3.7. Pittock Soil Benchmark Sites - Results of Statistical Analysis[1] for Annual Data Based on Slope Position.

Soil Property	Test			Control		
	Top	Middle	Bottom	Top	Middle	Bottom
Particle Size Distribution as Indicated by the Silt and Very Fine Sand Fraction (Calgon Dispersed)	NS	NS	NS	NS	NS	NS
Particle Size Distribution as Indicated by the Silt and Very Fine Sand Fraction (Water Dispersed)	-	-	-	-	-	-
Wet Aggregate Stability	NS	NS	*	NS	NS	NS
Plasticity Index (0-15 cm)	NS	NS	NS	NS	NS	NS
Plasticity Index (15-30 cm)	NS	NS	NS	NS	NS	NS
Available Moisture Holding Capacity (0-15 cm)	NA	NA	NA	NA	NA	NA
Available Moisture Holding Capacity (15-30 cm)	NA	NA	NA	NA	NA	NA
Cation Exchange Capacity	NS	NS	NS	NS	NS	NS
Bulk Density Ring Method (0-15 cm)	NS	NS	**	NS	NS	NS
Bulk Density Ring Method (15-30 cm)	NS	NS	NS	NS	NS	NS
Organic Carbon	NS	NS	NS	NS	NS	NS
Available P	NS	NS	NS	NS	NS	NS
Exchangeable K	*	NS	NS	*	**	NS
Exchangeable Mg	**	*	*	**	**	NS
Exchangeable Ca	NA	NA	NA	NA	NA	NA
Soil pH	NS	NS	*	NS	*	NS
$CaCO_3$	**	NS	*	NS	**	NS
Biological Activity Index	-	-	-	-	-	-
Wet Bulk Density	NS	NS	NS	NS	NS	NS
Field Soil Moisture Content	*	NS	NS	NS	NS	NS
Infiltration Rate	NS	*	NS	*	NS	NA

Note:
NS not significant at the $p < .05$ level of probability
* significant at the $p < .05$ level of probability
** significant at the $p < .01$ level of probability
- data not taken for soil parameter
NA not applicable, only 2 years of data available

---

[1] Linear regression of soil property on time.

control watershed also increased significantly but on a seasonal basis. In addition to this water aggregate stability and cation exchange capacity both increased in the control watershed whereas no change was evident in the test watershed (Table 3.5). On a slope position basis near surface bulk density increased and exchangeable K and Mg decreased significantly at various locations in the test watershed while in the control watershed exchangeable Mg was only noticed to change significantly at the middle slope position of the soil benchmark sites (Table 3.8) during the time span of the PWS.

3.5 Conclusions

- In general there appeared to be more measurable and contrasting change occurring amongst the soil quality parameters in the three test watersheds than in the three control watersheds although the change was not consistent amongst parameters or slope position.

- Uncontrolled differences and/or similarities in tillage and cropping practices between and amongst soil benchmark pairs made it difficult to monitor significant changes in soil quality parameters in the short term (3 years) of the PWS.

3.6 Recommendations

- In future projects, consideration should be given to holding soil samples, or perhaps splitting each soil sample and holding one of the resulting samples, through the life of the project (or for a suitable timespan) and having all of the samples analyzed by the same laboratory at the same time. This would avoid potential problems with changes in laboratory and analytical techniques that may impact on the study results.

- In short term projects (less than five years) it is critical that paired sites are similar not only in soil character but in soil management as well. Current management practices can influence yearly results and where long term trends are not an objective of the study, short term soil management practices should be similar between pairs and if possible groups of pairs.

Table 3.8. Kettle Soil Benchmark Sites - Results of Statistical Analysis[1] for Annual Data Based on Slope Position

Soil Property	Test			Control		
	Top	Middle	Bottom	Top	Middle	Bottom
Particle Size Distribution as Indicated by the Silt and Very Fine Sand Fraction (Calgon Dispersed)	NS	NS	NS	NS	NS	NS
Particle Size Distribution as Indicated by the Silt and Very Fine Sand Fraction (Water Dispersed)	-	-	-	-	-	-
Wet Aggregate Stability	*	NS	NS	**	NS	NS
Plasticity Index (0-15 cm)	NS	NS	NS	NS	NS	NS
Plasticity Index (15-30 cm)	*	NS	NS	NS	**	NS
Available Moisture Holding Capacity (0-15 cm)	NA	NA	NA	NA	NA	NA
Available Moisture Holding Capacity (15-30 cm)	NA	NA	NA	NA	NA	NA
Cation Exchange Capacity	NS	NS	NS	NS	NS	NS
Bulk Density Ring Method (0-15 cm)	NS	NS	*	NS	NS	NS
Bulk Density Ring Method (15-30 cm)	NS	NS	NS	NS	NS	NS
Organic Carbon	NS	NS	NS	NS	NS	NS
Available P	NS	NS	NS	NS	NS	NS
Exchangeable K	NS	*	**	NS	NS	NS
Exchangeable Mg	**	*	NS	NS	**	NS
Exchangeable Ca	NA	NA	NA	NA	NA	NA
Soil pH	NS	NS	NS	NS	NS	NS
$CaCO_3$	NS	NS	NS	NS	NS	NS
Biological Activity Index	-	-	-	-	-	-
Wet Bulk Density	NS	NS	NS	NS	NS	NS
Field Soil Moisture Content	**	*	NS	**	**	NS
Infiltration Rate	NS	NS	NS	NS	NS	NS

Note:		
	NS	not significant at the $p < .05$ level of probability
	*	significant at the $p < .05$ level of probability
	**	significant at the $p < .01$ level of probability
	-	data not taken for soil parameter
	NA	not applicable, only 2 years of data available

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[1] Linear regression of soil property on time.

- To obtain long term trends of change the monitoring period of soil benchmark sites should be carried out over five years or more. This would allow for the adoption and incorporation of conservation practices as part of the normal farming system.

- The soil benchmark data collected during the PWS could serve as a baseline data set from which future changes in soil quality could be monitored. In the Essex and Kettle watersheds in particular it is likely that the adoption of conservation systems will continue in the future. It is recommended that these soil benchmark sites be monitored every three to five years where adoption of conservation measures has occurred and alternatively where conventional practices have been maintained. This approach should document the long term effects of both systems on soil quality.

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4.0 IMPACT OF CONSERVATION SYSTEMS ON SOIL COVER AND CROP PRODUCTION

4.1 Introduction

Conservation systems affect soil erosion control potential, water quality, crop management strategies and crop productivity. The impact of these systems can be evaluated in several ways and at several levels.

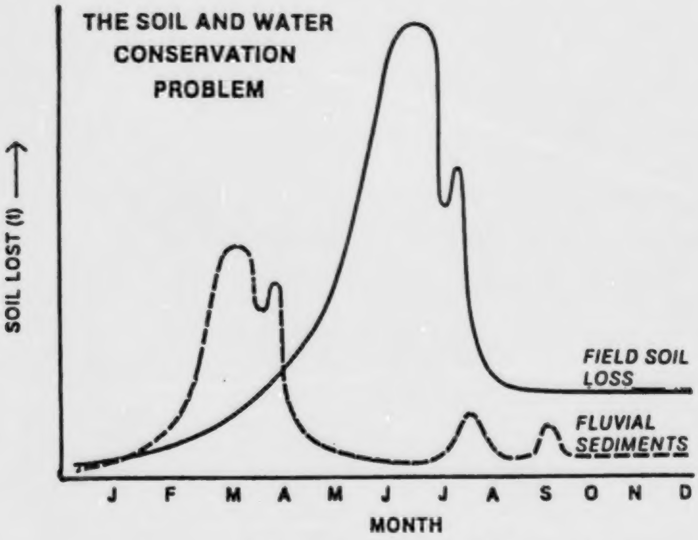
At the watershed level in the PWS the evaluation of conservation systems focused on changes in soil cover. This was the one factor affected by crop production practices that most directly influenced soil erosion control, sediment delivery and ultimately water quality as evidenced by sediment and phosphorus loadings.

As indicated in Figure 4.1 there is a relationship between time of year, soil erosion from agricultural fields and sediment loading to water courses. Generally the highest soil losses occur during May, June and July; the period just after planting when the crop canopy is still developing. The highest sediment loadings generally occur in the spring during February, March and April. In the PWS soil cover data were collected at these critical periods to obtain an indication of the potential effect of adopting conservation practices on a watershed basis on soil erosion and water quality.

The cumulative effect of soil cover on soil erosion and water quality is further determined by the proportion of the watershed influenced by relatively high levels of cover. Figure 4.2 shows the relationship between residue cover and soil loss reduction. For the purposes of the PWS this relationship may be extended to include living cover as well as dead residue since the main effect of intercepting rainfall energy is still valid whether the material is alive or dead.

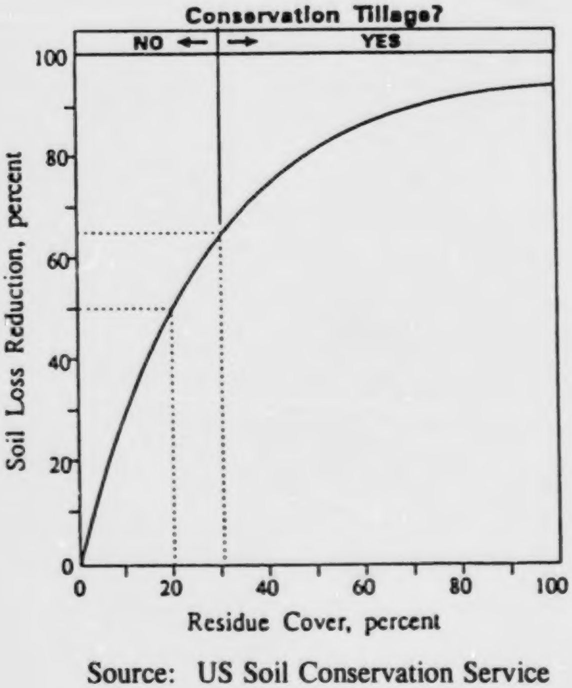
In the PWS cooperators were not expected to immediately achieve maximum effectiveness from a soil cover standpoint since the adoption of conservation systems would first involve learning how to manage increased cover while maintaining crop production on their farms. Target soil cover levels were set though in order to provide a tangible and achievable goal for the cooperators to strive for. As further indicated in Figure 4.2 it was anticipated that these targets, when met, would reduce soil loss on average by at least 50%.

Figure 4.1 The Soil and Water Conservation Problem



Source: OMAF Soil Erosion Control Manual

Figure 4.2 Relationship of Residue Cover to Soil Loss Reduction



Source: US Soil Conservation Service

In the PWS the impact of conservation systems on crop production at the farm and field level were left to the cooperators to evaluate in the context of their own operations, their previous experience and their personal production goals. Information and technical assistance were provided to the cooperators to assist them in this evaluation but the final analyses and decisions were left up them. The results of these evaluations are indicated in part by the findings in the report, Implementation of Conservation Systems, Pilot Watershed Study, SWEEP (Ecologistics Limited, 1994). In essence the indicators of adoption were strong and favourable revealing that during the study cooperator evaluations of the conservation systems were positive.

For comparative purposes information related to two crop production parameters, use of commercial phosphorus fertilizer and crop yields, is also reported on a watershed basis in the following section.

4.2 Objectives

The specific objectives related to the crop monitoring program were designed to fulfil the general objective and strategies listed in Section 1.4.

The specific objectives of the crops monitoring program were as follows:

- to determine the proportion of the soil surface covered with crop live crop or dead residue at critical times in the cropping season;
- to monitor pests, soil fertility, weather, and other factors that influence crop performance during the crop production season; and
- to monitor whole plant grain yields of crops.

4.3 Materials and Methods

4.3.1 Soil Cover

Soil cover within the cropped areas of the watersheds was estimated using either the knotted rope method or a series of assumptions based on previous knowledge or experience. The details of both methods are found in Appendices C and D, respectively.

4.3.2 Crop Production

Factors affecting crop production were tracked on a field and watershed basis by monitoring cooperator management decisions, weather, soil fertility and crop pests.

Cooperator management decisions are reflected in the report (Ecologistics Limited, 1994), Implementation of Conservation Systems, Pilot Watershed Study, SWEEP and in the field record books maintained for the economic analysis component of SWEEP.

Weather records are found in the report, Study Area Selection, Description and Climate, Pilot Watershed Study, SWEEP (Ecologistics Limited and Beak Consultants Limited, 1994).

One of the broad objectives of SWEEP was to reduce phosphorus loading from non-point agricultural sources to Lake Erie. Of interest in this regard was the level of phosphorus fertilizer applied to the fields within each watershed in the PWS at the beginning and end of the project. To assist the cooperators in determining the amount of phosphorus required to produce their crops soil fertility samples were taken in the fall of 1988 and again in the fall of 1991. The soil analyses results were passed on to the cooperators along with fertilizer recommendations for various crops, from the OMAF publication *Field Crop Recommendations* (OMAF, Publication 296).

A limited amount of fertilizer information was available in 1989 based on the number of fields and area reporting in all the test watersheds (see section 4.4.2, Table 4.1). This in part was due to the incomplete fertilizer information recorded in the field booklets. The personal contact of the watershed technicians in 1992 increased the available information in the Essex and Kettle test watersheds. In the Pittock test watershed some cooperators were reluctant to disclose their fertility practices and therefore reduced the number of fields and areas reporting information.

Details of the methods used for monitoring soil fertility and crop pests are found in Appendix C.

The methodology for estimating grain yields using the weigh wagon is also found in Appendix C. Other yield data were calculated using the grain weigh slips obtained by the cooperators at the grain elevator, the area represented by the weigh slip and the grain moisture content (similar to the calculation used with weigh wagon yield estimates). Only those yield estimates based on the above methods were included in the data set.

4.4 Results and Discussion

4.4.1 Soil Cover

Table 4.1 indicates the annual change in soil cover on each of the test and control watersheds after spring runoff and planting; two critical periods when the soil is particularly prone to erosion. The data include residue cover from the previous crop where annual row crops (corn, beans) were planted and live cover from the current crop where perennial (hay) or established cereal (winter wheat, barley in June) crops were planted.

As indicated in the report, Implementation of Conservation Systems, Pilot Watershed Study, SWEEP, cooperators in the test watersheds were encouraged to leave varying amounts of crop residue on the soil surface after planting annual row crops and depending on which test watershed they were located in (Ecologistics Limited, (1994). In the Essex test watershed 20% residue cover after planting was set as the target. In Kettle the target was 30% residue cover and in Pittock it was 25%. These targets represented achievable levels of effectiveness given the significant transitions required of the cooperators during the adoption of conservation systems.

Essex Watersheds:

After spring runoff in the Essex watersheds the area affected by greater than 30% soil cover tended to increase in the test watershed and decrease slightly in the control watershed from 1989 to 1992. The opposite trend was evident for the area affected by soil cover between 0-20%. A relatively small proportion of the total area monitored fell within the 21-30% cover category. Aside from a jump in area in the control watershed in 1990 the proportion of land in this category was similar in both watersheds throughout the study. In consideration of the adoption objectives of the PWS, change in this latter category may

Table 4.1. Change in Area Affected by Levels of Soil Cover After Spring Runoff and After Planting, 1989-92, Essex, Kettle and Pittock Watersheds, Pilot Watershed Study, SWEEP

% of Area Monitored								
Residue Levels	1989		1990		1991		1992	
	Test	Control	Test	Control	Test	Control	Test	Control
Essex Watershed - After Spring Runoff								
0-20%	59	61	42	49	36	65	37	72
21-30%	4	5	3	17	7	6	3	0
31%+	37	34	56	33	57	30	61	28
Essex Watershed - After Planting								
0-20%	68	81	82	73	70	84	52	82
21-30%	7	0	2	0	5	5	3	0
31%+	26	20	17	27	25	11	45	19
Kettle Watershed - After Spring Runoff								
0-20%	58	34	40	64	23	53	14	84
21-30%	0	0	13	8	3	0	7	0
31%+	42	66	47	29	74	47	79	16
Kettle Watershed - After Planting								
0-20%	63	56	65	69	51	74	28	83
21-30%	14	5	5	1	10	0	7	0
31%+	23	39	30	31	40	26	65	17
Pittock Watershed - After Spring Runoff								
0-20%	73	36	34	46	39	46	39	58
21-30%	2	0	5	3	9	2	3	3
31%+	25	64	61	51	52	52	58	38
Pittock Watershed - After Planting								
0-20%	63	91	65	77	75	80	67	70
21-30%	0	0	5	0	0	1	10	0
31%+	37	9	31	23	25	19	23	30

indicate the amount of land in a transitional phase with regard to the adoption of high residue management practices.

As indicated earlier, the after planting residue cover target for the Essex test watershed was 20%. A review of the data show that not all of the area affected by 21%+ cover in the test watershed during spring runoff was maintained at this soil cover level after planting. On average during the four year transitional period between 1989 and 1992, 58% of the area monitored was maintained at the 21%+ soil cover level after planting. The absolute area however was still generally greater than that left in the control watershed after planting.

Given the early stage of adoption of conservation cropping systems represented by the data, the results suggest that on the clay soils in the Essex test watershed cooperators achieved an elevated level of soil cover. This occurred at the critical erosion periods at spring runoff and after planting within the time frame of the study and when compared to the control watershed.

Kettle Watersheds:

In the Kettle test watershed after spring runoff, the area affected by soil cover greater than 30% steadily increased throughout the life of the study and when compared to the control watershed. In fact the area affected by 31%+ soil cover levels tended to decrease in the control watershed during the same period.

After planting the above trends continued although the actual area affected by elevated soil cover levels declined. Cooperators were encouraged to achieve an after planting residue cover target of 30% for annual row crops. From 1989 to 1992 approximately 64% of the area with greater than 30% soil cover after spring runoff was maintained at this level (includes dead residue and live crop cover) after row crop planting in June.

Pittock Watersheds

In the Pittock test watershed after spring runoff, the area affected by 31%+ soil cover appeared to increase initially during the study and then level off. In contrast the area affected by the same level of cover in the control watershed appeared to decrease during the study although not always relative to the test watershed.

The above trends were not sustained after planting. There was a gradual decline in the area affected by soil cover greater than 30% in the test watershed during the study although in three out of four years the total area was greater than that in the control watershed. In the control watershed the area affected by greater than 30% soil cover fluctuated from year to year. When the area affected by soil cover in the 21-30% range was added to the above totals (since target residue levels were set at 25% cover), the decline in area was less affected. Over the four years of the study an average of 72% of the area affected by 20%+ soil cover after spring runoff was maintained at this level of cover after planting.

In Pittock the higher incidence of hay crops in the rotation relative to the other test watersheds, affected the overall results by masking real gains in the area affected by high residue cover and planted to row crops. In addition to this no-till was adopted to a lesser degree than in the other two test watersheds making it even more difficult to assess real change in row crop management strategies.

It should be noted however that while the presence of hay made the monitoring of real change in residue cover more difficult, hay in itself is very beneficial from the standpoint of controlling erosion and maintaining crop production capabilities. It was thus encouraged as a valid conservation practice.

The results indicate that understanding the influence of adopting conservation measures on soil cover within a watershed context is complicated by the presence of hay-based rotations.

In general the amount of soil cover and area affected increased during the study in the test watersheds and relative to the control watersheds. Approximately one half to three quarters of the area affected by elevated soil cover levels (20%+) during spring runoff continued to be affected by soil cover levels greater than 20% after planting (during late May and early June).

4.4.2 Factors Affecting Crop Performance and Crop Yield

Crop management and performance were evaluated by the cooperators on a field basis using past experience and to varying extent, the information and technical advice provided through the PWS on conservation cropping systems, soil fertility levels, incidence of crop pests and estimates of grain yields (see the report, Implementation of Conservation Systems, Pilot Watershed Study, SWEEP (Ecologistics Limited, 1994). In general the combined result of individual cooperator evaluations is reflected by those indicators of adoption discussed in the afore-mentioned report.

From a watershed perspective however, the general findings regarding soil fertility levels and the amount of commercial phosphorus fertilizer recommended versus that used within the watersheds is of interest. In addition to this the average and range of crop yields found within the test and control watersheds are also reported for comparative purposes.

Fertilizer Use:

As shown in Table 4.2 the actual amount of phosphorus fertilizer applied to each test watershed was reduced considerably between 1989 and 1992. This reduction may be attributed to annual crop mix in the watersheds, one or more cooperators acting on a better knowledge of the phosphorus levels in their fields and an increased awareness of the concern about phosphorus levels entering the Great Lakes from non-point agricultural sources.

In comparing the proportion of phosphorus fertilizer actually applied with the level recommended for application between 1989 and 1992 the greatest reduction was recorded in Pittock (229% reduction), followed by Kettle (204% reduction) and Essex (58% reduction).

The total amount recommended and applied varied for each watershed depending on the crop mix i.e. corn requires more phosphorus fertilizer than other crops such as soybeans and some cereals. In general a few cooperators who over applied phosphorus fertilizer tended to significantly influence the data for the whole watershed. Changing these over application practices had a positive effect on the total phosphorus applied per watershed. On the other hand it should be noted that it is difficult to calibrate current fertilizer application equipment to reduce by marginal amount (10 to 20 kg/ha) the level of fertilizer applied. As a result widespread but marginal over application is difficult to remedy.

Table 4.2. A Summary of Recommended and Actual Amounts of Phosphorus Fertilizer Applied to the Test Watersheds in 1989 and 1992, Pilot Watershed Study, SWEEP

	Essex Test		Kettle Test		Pittock Test	
	1989	1992	1989	1992	1989	1992
Fields Number Reporting Fertilizer Application	23	40	29	63	32	28
Area Area Reporting (ha=X)	165	368	174	334	200	120
Total Phosphorus (P_2O_5) Recommended (kg/X ha)	500	720	510	870	320	730
Actual (kg/X ha)	692	581	1456	708	1148	952
Proportion of Recommended Rate that was Actually Applied (%)	138	81	285	81	359	130

Crop Yields:

A summary of crop yield data for grain corn, soybeans and winter wheat in each watershed is given in Tables 4.3 to 4.5. The data indicate the general level of crop performance on an annual basis in each pair of test and control watersheds. It is interesting to note that the average and range of crop yields can change significantly between years regardless of whether the data pertain to the test or control watersheds.

No difference in crop performance potential was detected between each pair of test and control watersheds based on yield data (or any other data) collected during the PWS.

Table 4.3. Grain Corn Seed Yield[1], 1989-91, Pilot Watershed Study, SWEEP.

Crop Year	Number of Fields Reporting		Average Yield of All Fields (kg ha^{-1})		Range of Yields (kg ha^{-1})	
	Control	Test	Control	Test	Control	Test
Essex						
1989	3	4	8906	7470	6648 - 10035	6523 - 8524
1990	2	1	6918	8047	6836 - 7000	8047
1991	1	5	3757	3763	3757	2703 - 5344
Kettle						
1989	6	10	7649	7565	6460 - 8981	5475 - 8981
1990	12	11	6506	7487	3418 - 8668	3719 - 8925
1991	15	19	6150	6031	3017 - 7928	3920 - 7928
Pittock						
1989	8	10	8487	8345	7056 - 9972	7652 - 10223
1990	9	14	7856	8191	6203 - 9458	7401 - 8963
1991	16	18	9710	9941	6730 - 11133	6517 - 11597

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[1] Yields for individual fields were obtained from weigh wagon checks or elevator weight slips.

Table 4.4. Soybean Seed Yield[1], 1989-91, Pilot Watershed Study, SWEEP

Crop Year	Number of Fields Reporting		Average Yield of All Fields (kg ha^{-1})		Range of Yields (kg ha^{-1})	
	Control	Test	Control	Test	Control	Test
Essex						
1989	9	14	2788	2798	1058 - 3360	1788 - 3326
1990	5	17	2668	3009	1982 - 3790	2513 - 3857
1991	3	19	2085	2194	1714 - 2715	1290 - 3945
Kettle						
1989	4	7	2681	2669	2392 - 2890	2318 - 3105
1990	7	17	2644	2234	2009 - 3360	1001 - 3279
1991	8	16	2232	2007	1485 - 2466	968 - 2964
Pittock						
1989	1	2	3526	2621	3526	2621
1990	0	3	-	2856	-	2520 - 3024
1991	1	4	3427	2928	3427	2433 - 3629

Table 4.5. Winter Wheat Seed Yield[1], 1989-91, Pilot Watershed Study, SWEEP.

Crop Year	Number of Fields Reporting		Average Yield of All Fields (kg ha^{-1})		Range of Yields (kg ha^{-1})	
	Control	Test	Control	Test	Control	Test
Essex						
1989	3	8	3942	5026	3562 - 4301	3763 - 7849
1990	2	7	5952	5183	5588 - 6317	4778 - 6021
1991	0	1	-	2513	-	2513
Kettle						
1989	3	6	4556	4691	4260 - 5040	2957 - 9341
1990	5	10	4619	4546	3730 - 5504	2755 - 5524
1991	2	12	4076	3777	3548 - 4603	2856 - 5430
Pittock						
1989	0	3	-	5208	-	4704 - 5813
1990	4	5	4941	5453	3152 - 5712	4119 - 6082
1991	12	2	3777	4647	2406 - 5430	4052 - 5242

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[1] Yields for individual fields were obtained from weigh wagon checks or elevator weigh slips.

4.5 Conclusions

In general the amount of soil cover and area affected increased in the test watersheds during the study and relative to the control watersheds.

Approximately one half to three quarters of the monitored agricultural areas within the test watersheds that were affected by elevated soil cover levels (20%+) during spring runoff, continued to be affected by soil cover levels greater than 20% after planting (during late May and early June).

The adoption of conservation systems during the PWS impacted to a greater degree on the soil cover remaining after spring runoff when compared to the soil cover remaining after planting.

Understanding the influence of the adoption of conservation measures on soil cover within the Pittock watersheds was complicated by the presence of hay-based rotations.

At the beginning of the PWS the actual application of phosphorus fertilizer on a watershed basis was approximately 1.4 to 3.6 times greater than recommended amounts and at the end of the PWS the actual application of phosphorus fertilizer on a watershed basis fell to approximately .8 to 1.3 times the recommended rates.

Over application of phosphorus fertilizers can be significantly reduced on a watershed basis if information about soil fertility levels and phosphorus loading of water courses is provided to the producers.

No difference in crop production potential was detected between each pair of test and control watersheds based on yield data (or any other data) collected during the PWS.

4.6 Recommendations

With regard to the above findings and the impact of conservation systems on crop performance it is recommended that:

- the use of conservation practices be promoted to sustain increased levels of residue cover on a field or watershed basis;

- additional clarification regarding the potential contribution of commercial fertilizer to phosphorus loadings be published;

- producers be encouraged to examine their phosphorus fertilizer programs to ensure maximum efficiency; and

- the methods and equipment for calibrating fertilizer application rates be improved.

4.7 References

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APPENDIX A

FIELD SAMPLING PROCEDURE FOR SOILS MONITORING PROGRAM

A1.0 Locating Benchmarks (Annual and Seasonal)

Benchmark locations were roughly determined by using the maps drawn up by Ecological Services for Planning Limited (ESP, 1990). At the approximate benchmark location a 3M® Near Surface Marker Detector was used to identify the exact location. Problems arose in detecting the exact location of some benchmarks due to the markers either being buried too deep, moved by farm machinery (ploughing) or incorrect directions indicated on the original map. When the original location was not found a replacement marker was buried as close to the original site as possible. As well the map was updated, flags placed along the field edge and at the benchmark site to ensure return to the correct location in the future.

A2.0 Soil Methodology

A2.1 Infiltrometer Measurements

A Guelph Pressure Infiltrometer (GPI) was used to measure the infiltrometer rate using the two head (5 and 15 cm) technique as described in the GPI manual for the annual and seasonal sampling dates. Three undisturbed areas were selected near the centre of the benchmark for measurement. The infiltrometer ring was inserted to approximately a 4 cm depth.

On a standard form the infiltrometer data were recorded as well as X/Y parameters, inner/outer parameters, insertion depth and any problems that occurred during the measurement.

A2.2 Wet Bulk Density and Soil Moisture Content

Using a Campbell Pacific Nuclear (CPN) Portaprobe wet bulk density readings were made at 5, 10, 15, 20, 25 and 30 cm depths using a one-quarter minute counting time at three undisturbed locations near the centre of the benchmark site for the annual and seasonal sampling dates.

At these same locations soil moisture content was recorded at the 5 and 10 cm depths. In addition the soil moisture content at the 20 cm and 35 cm depths were recorded at one location. A 15 cm depth hole was dug, the probe placed in the hole and the handle moved to the 5 cm notch. A one-quarter minute count moisture reading was taken. The hole was further excavated to 30 cm and the same procedure repeated. The hole was filled ensuring the subsoil and topsoil were not mixed.

Calibration constants for the CPN Portaprobe were recorded immediately after the field measurements were completed. These records were stored at Ecologistics Limited in a reference binder.

A2.3 Particle Size Distribution

Within 5 m of the benchmark site centre, perpendicular to the slope gradient, three small holes to a depth of 20 cm were excavated using a hand trowel. From a clean side of each of the holes a slice of soil to a 15 cm depth was removed with the hand trowel and placed in the prelabelled sample bag. The three samples were composited and submitted to Analytical Services Laboratory, University of Guelph for determination of particle size distribution. The water dispersed method was to be used on the seasonal samples while the calgon dispersed method for the annual samples.

A2.4 Biological Activity Index

Samples for biological activity index were collected in the same manner as described for particle size distribution (A2.3). However these composited samples were stored in a cool place (cooler) until delivery to the analytical laboratory. Biological activity index was only determined for the seasonal samples.

A2.5 Atterberg Limits, Organic Matter Content, Percent Carbonates, Cation Exchange Capacity, pH, Fertility and Aggregate Stability

Following the sampling procedures described for the PSD (A2.3) bulk samples were selected for determination of Atterberg limits, organic matter content (%), carbonates (%), cation exchange capacity, pH, fertility (available P, exchangeable K, Mg and Ca) and aggregate stability at each benchmark on an annual basis.

At the three sample holes previously used to collect the 0 - 15 cm in depth samples the depth was increased to 40 cm. Starting at the 15 cm depth, a slice of soil was taken from a clean side of the hole, to 30 cm. The samples were composited and submitted for determination of the Atterberg Limits.

A2.6 Bulk Density and Available Moisture Holding Capacity

Sampling for bulk density and available moisture holding capacity occurred at the same three locations identified in A2.5 on an annual basis.

Smeared soil was removed using a spatula from the sides of the hole prior to sampling. The sharp edge of the aluminum core was pressed into the vertical face of the soil at the 10 cm depth for the 0-15 cm depth data. Using a flat piece of wood and rubber mallet the ring was pushed fully into the soil. A dummy ring (an aluminum core without a sharp edge) was placed on top of the sample ring. Using the same method as above, the rings were driven deeper into the soil until the dummy ring was just protruding from the soil. The soil surrounding the rings was carefully dug away using a hand trowel. Any soil extending from the ends of the sampling core was left in place to be trimmed by the laboratory. The sample was placed in a plastic bag. The bag was tightened around the sample to reduce the amount of moisture loss.

For the 15-30 cm depth data the aluminum core was placed at the 20 cm depth and the steps above repeated.

Two aluminum cores were taken at each depth, one for bulk density and one for available moisture holding capacity, at the three sampling locations per benchmark.

The hole was filled ensuring the subsoil and topsoil were not mixed.

APPENDIX B

BENCHMARK RAW DATA - SOILS

The following soils raw data for the benchmarks is contained within this appendix:

1. Pressure Infiltrometer
    - Average Kfs Values (m/s)
    - Annual and seasonal data*
2. Bulk Density
    - measured with the CPN Portaprobe (g/m^3)
    - 5, 10, 15, 20, 25 and 30 cm depths
    - Annual and seasonal data
3. Moisture Content
    - measured with the CPN Portaprobe (%) (0-30 cm)
    - Annual and seasonal data
4. Average Bulk Density
    - Ring Method
    - 0-15 and 15-30 cm depths
    - Annual data
5. Particle Size Distribution - Calgon Dispersed
    - % gravel, very coarse sand, coarse sand, medium sand, fine sand, very fine sand, sand, silt and clay
    - Annual data
6. Particle Size Distribution - Water Dispersed
    - % gravel, very coarse sand, coarse sand, medium sand, fine sand, very fine sand, sand, silt and clay
    - Seasonal data
7. Biological Activity Index
    - mg/kg
    - Seasonal data

8. Atterburg Limits	- Plasticity Index - 0-15 and 15-30 cm depths - Annual data
9. Organic Matter	- % - Annual data
10. Fertility Levels	- mg/l - phosphorus, potassium, magnesium and calcium - Annual data
11. Aggregate Stability	- Wet Aggregate Stability (%) - 1990 and 1991 data adjusted for soil moisture content - Annual data
12. pH	- Annual data
13. Cation Exchange Capacity	- meq/100g - Annual data
14. Calcium Carbonate	- $CaCo_3$ (%) - Annual data
15. Available Moisture Holding Capacity (% by mass)	- Saturated, 100 mB and 15 Bar - 0-15 and 15-30 cm depths - Annual Data

* **Annual Data** - collected after harvest but prior to fall primary tillage in 1989, 1990 and 1991. Information collected on all 38 benchmark sites.

Seasonal Data - collected post plant 1990, post harvest 1990, pre-plant 1991, post plant 1991 and post harvest 1991. Information collected on one set of three (top, mid, bottom slope positions) benchmarks in each watershed for a total of 18 benchmark sites.

Pressure Infiltrometer Average Kfs Values (m/s) SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre-plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	1.829E-06	3.191E-05	1.337E-05	1.608E-05	3.191E-05	7.020E-06	3.990E-05	1.337E-05
2	EIT2	1.685E-04	1.774E-06	1.448E-05	1.077E-05	1.774E-06	1.630E-07	1.480E-05	1.448E-05
3	E1T3	5.040E-06	9.362E-05	5.884E-05	4.019E-05	9.362E-05	2.68E-05	1.72E-05	5.884E-05
4	E1C1	1.040E-05	8.568E-06	3.387E-05	1.080E-05	8.568E-06	6.340E-07	1.320E-06	3.387E-05
5	E1C2	5.306E-05	2.682E-05	--	1.88E-05	7.78E-06	7.78E-06	6.75E-06	--
6	E1C3	1.140E-05	1.57E-05	2.14E-05	3.48E-05	1.57E-05	1.120E-05	4.89E-06	2.14E-05
7	K1T1	1.311E-05	7.90E-06	6.00E-05	4.15E-06	7.90E-06	8.92E-06	1.19E-05	6.00E-05
8	K1T2	2.904E-06	7.85E-06	1.34E-05	3.75E-06	3.44E-06	3.44E-06	3.33E-05	1.34E-05
9	KIT3	1.347E-05	2.39E-06	3.21E-05	1.09E-06	7.14E-05	7.14E-05	1.93E-05	3.21E-05
10	K1C1	7.750E-05	1.326E-05	1.22E-05					
11	K1C2	1.347E-05	1.69E-05	1.61E-05					
12	K1C3	--	1.30E-05	1.97E-05					
13	K2T1	1.952E-05	--	2.85E-05					
14	K2T2	2.797E-05	--	2.85E-05					
15	K2T3	2.316E-05		2.67E-05					
16	K2C1	--	1.64E-05	5.35E-05	5.39E-06	1.64E-05	3.57E-05	1.52E-05	5.35E-05
17	K2C2	--	1.55E-05	3.39E-05	4.58E-06	1.55E-05	3.89E-06	3.76E-05	3.39E-05
18	K2C3	--	--	1.61E-05	6.31E-06	--	1.45E-05	4.23E-06	1.61E-05
19	K3T1	2.897E-05	1.66E-05	4.81E-05					
20	K3T2	6.716E-06	1.07E-05	1.49E-05					
21	K3T1A	2.338E-05	4.56E-05	4.81E-05					
22	K3C1	3.304E-05	9.46E-06	8.92E-05					
23	K3C2	1.043E-05	6.25E-06	5.05E-05					
24	P1T1	2.515E-05	--	4.46E-05	1.64E-05	--	4.69E-06	1.90E-05	4.46E-05
25	P1T2	1.616E-05	--	5.35E-05	9.98E-06	--	9.10E-07	2.05E-05	5.35E-05
26	P1T3	4.618E-05	--	6.62E-05	1.38E-05	--	4.14E-07	1.69E-05	6.62E-05
27	P1T3A	1.754E-05	--	1.43E-05					
28	P1C1	1.032E-05	--	3.57E-05	4.92E-05	--	3.58E-06	7.14E-06	3.57E-05
29	P1C2	8.199E-06	--	4.46E-05	5.61E-06	--	3.72E-06	6.61E-06	4.46E-05
30	P1C3	1.185E-05	--	3.57E-05	6.48E-06	--	6.35E-07	6.85E-06	3.57E-05
31	P2T1	3.245E-06	1.91E-05	5.17E-05					
32	P2T2	1.077E-05	1.88E-05	5.53E-05					
33	P2C1	1.772E-05	--	FROZEN					
34	P2C2	1.732E-05	--	N/A					
35	P3T1	1.323E-05	1.58E-05	1.96E-05					
36	P3T2	1.682E-05	1.97E-05	2.14E-05					
37	P3C1	3.333E-06	1.79E-05	5.13E-05					
38	P3C2	2.693E-06	6.97E-06	2.05E-05					

Bulk Density (g/m3) (CNP Portaprobe)15 cm depth SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	1.39	0.78	1.12	0.69	0.78	0.95	1.21	1.12
2	EIT2	1.27	0.63	1.03	0.82	0.78	0.83	1.13	1.03
3	E1T3	1.30	0.57	1.09	0.68	0.57	0.84	1.13	1.09
4	E1C1	1.29	0.80	1.32	0.96	0.80	1.19	1.21	1.32
5	E1C2	1.34	0.86	––	0.95	0.86	1.01	1.31	––
6	E1C3	1.16	0.71	1.15	0.85	0.71	1.12	1.12	1.15
7	K1T1	––	1.16	1.15	1.10	1.16	1.09	1.14	1.15
8	K1T2	––	1.01	1.31	1.08	1.14	1.14	1.30	1.31
9	KIT3	––	1.04	1.17	0.87	1.16	1.16	1.10	1.17
10	K1C1	1.27	1.00	1.19					
11	K1C2	1.24	0.99	1.18					
12	K1C3	1.15	0.97	1.10					
13	K2T1	1.27	1.07	1.36					
14	K2T2	1.49	0.91	1.36					
15	K2T3	1.30	0.79	1.41					
16	K2C1	––	1.08	1.29	––	1.08	1.06	1.24	1.29
17	K2C2	––	0.63	1.22	1.02	0.63	1.08	1.20	1.22
18	K2C3	––	0.67	1.12	0.94	0.67	1.09	1.24	1.12
19	K3T1	1.42	1.13	1.35					
20	K3T2	1.43	0.95	1.19					
21	K3T1A	1.39	1.10	1.37					
22	K3C1	1.37	1.00	1.24					
23	K3C2	1.45	1.07	1.34					
24	P1T1	1.28	0.91	1.19	0.94	0.91	1.16	1.20	1.19
25	P1T2	1.26	1.04	1.21	0.92	1.04	1.18	1.21	1.21
26	P1T3	1.08	0.75	0.86	1.01	0.75	0.97	1.17	0.86
27	P1T3A	1.24	1.04	1.01					
28	P1C1	1.31	0.92	1.16	0.75	0.92	1.36	1.19	1.16
29	P1C2	1.12	0.99	1.11	0.74	0.99	1.39	1.23	1.11
30	P1C3	1.11	0.77	1.17	0.74	0.77	1.23	1.17	1.17
31	P2T1	1.33	0.76	1.23					
32	P2T2	1.30	0.83	1.11					
33	P2C1	1.01	––	0.93					
34	P2C2	1.13	––	1.09					
35	P3T1	––	0.65	1.07					
36	P3T2	––	0.77	1.19					
37	P3C1	1.05	0.94	1.36					
38	P3C2	0.95	0.70	1.20					

Bulk Density (g/m3) (CNP Portaprobe) 10 cm depth SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre-plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	1.38	1.05	1.27	0.91	1.05	1.15	1.36	1.27
2	EIT2	1.33	0.92	1.14	1.01	1.05	10.60	1.29	1.14
3	E1T3	1.38	0.96	1.27	0.94	0.96	1.07	1.28	1.27
4	E1C1	1.38	1.06	1.44	1.18	1.06	1.37	1.35	1.44
5	E1C2	1.42	1.11	--	1.13	1.11	1.17	1.41	--
6	E1C3	1.27	0.86	1.27	1.14	0.86	1.28	1.28	1.27
7	K1T1	--	1.27	1.39	1.28	1.27	1.32	1.38	1.39
8	K1T2	--	1.14	1.47	1.23	1.18	1.31	1.43	1.47
9	KIT3	--	1.08	1.28	1.07	1.13	1.27	1.26	1.28
10	K1C1	1.40	1.14	1.34					
11	K1C2	1.28	1.12	1.43					
12	K1C3	1.24	1.03	1.29					
13	K2T1	1.38	1.27	1.56					
14	K2T2	1.52	1.08	1.48					
15	K2T3	1.32	1.06	1.44					
16	K2C1	--	1.18	1.40	--	1.18	1.26	1.37	1.40
17	K2C2	--	0.76	1.30	1.20	0.76	1.15	1.33	1.30
18	K2C3	--	0.74	1.28	1.03	0.74	1.23	1.38	1.28
19	K3T1	1.53	1.23	1.44					
20	K3T2	1.43	1.13	1.32					
21	K3T1A	1.43	1.25	1.55					
22	K3C1	1.36	1.15	1.39					
23	K3C2	1.47	1.14	1.48					
24	P1T1	1.35	1.01	1.30	1.16	1.01	1.23	1.30	1.30
25	P1T2	1.31	1.08	1.31	1.03	1.08	1.28	1.39	1.31
26	P1T3	1.23	1.04	1.07	1.14	1.04	1.12	1.29	1.07
27	P1T3A	1.36	1.13	1.13					
28	P1C1	1.42	0.98	1.26	0.99	0.98	1.39	1.30	1.26
29	P1C2	1.16	1.00	1.25	0.97	1.00	1.40	1.33	1.25
30	P1C3	1.16	0.84	1.25	0.96	0.84	1.25	1.29	1.25
31	P2T1	1.34	0.83	1.37					
32	P2T2	1.32	0.83	1.14					
33	P2C1	1.09	--	1.08					
34	P2C2	1.21	--	1.26					
35	P3T1	--	0.82	1.26					
36	P3T2	--	0.86	1.29					
37	P3C1	1.05	1.08	1.43					
38	P3C2	1.02	0.99	1.33					

Bulk Density (g/m3) (CNP Portaprobe) 15 cm depth SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	1.42	1.21	1.36	1.12	1.21	0.25	1.43	1.36
2	EIT2	1.38	1.15	1.24	1.15	1.21	1.19	1.37	1.24
3	E1T3	1.42	1.12	1.33	1.09	1.12	1.18	1.36	1.33
4	E1C1	1.40	1.15	1.49	1.30	1.15	1.38	1.44	1.49
5	E1C2	1.47	1.14	--	1.23	1.14	1.27	1.49	--
6	E1C3	1.35	0.89	1.37	1.24	0.89	1.36	1.36	1.37
7	K1T1	--	1.36	1.51	1.39	1.36	1.45	1.49	1.51
8	K1T2	--	1.28	1.55	1.34	1.15	1.41	1.54	1.55
9	KIT3	--	1.14	1.32	1.15	1.03	1.30	1.36	1.32
10	K1C1	1.46	1.20	1.38					
11	K1C2	1.28	1.09	1.47					
12	K1C3	1.32	1.20	1.37					
13	K2T1	1.43	1.29	1.62					
14	K2T2	1.56	1.16	1.50					
15	K2T3	1.35	1.20	1.45					
16	K2C1	--	1.21	1.44	--	1.21	1.32	1.47	1.44
17	K2C2	--	0.84	1.40	1.31	0.84	1.21	1.38	1.40
18	K2C3	--	0.78	1.37	1.10	0.78	1.25	1.44	1.37
19	K3T1	1.57	1.26	1.50					
20	K3T2	1.43	1.20	1.38					
21	K3T1A	1.48	1.37	1.64					
22	K3C1	1.43	1.25	1.49					
23	K3C2	1.51	1.21	1.54					
24	P1T1	1.33	1.09	1.35	1.21	1.09	1.24	1.43	1.35
25	P1T2	1.26	1.15	1.35	1.13	1.15	1.33	1.49	1.35
26	P1T3	1.26	1.08	1.09	1.17	1.08	1.19	1.36	1.09
27	P1T3A	1.38	1.18	1.23					
28	P1C1	1.40	0.98	1.31	1.10	0.98	1.39	1.38	1.31
29	P1C2	1.18	1.02	1.29	1.08	1.02	1.38	1.38	1.29
30	P1C3	1.16	0.90	1.29	1.05	0.90	1.27	1.33	1.29
31	P2T1	1.33	0.80	1.41					
32	P2T2	1.32	0.84	1.21					
33	P2C1	1.14	--	1.17					
34	P2C2	1.27	--	1.31					
35	P3T1	--	0.86	1.30					
36	P3T2	--	0.85	1.35					
37	P3C1	1.12	1.15	1.46					
38	P3C2	1.04	1.61	1.39					

Bulk Density (g/m3) (CNP Portaprobe) 20 cm depth SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	1.42	1.33	1.43	1.24	1.33	1.31	1.47	1.43
2	EIT2	1.38	1.28	1.32	1.25	1.33	1.26	1.43	1.32
3	E1T3	1.47	1.24	1.37	1.19	1.24	1.26	1.42	1.37
4	E1C1	1.43	1.25	1.56	1.35	1.25	1.43	1.48	1.56
5	E1C2	1.49	1.21	--	1.31	1.21	1.35	1.54	--
6	E1C3	1.40	1.09	1.42	1.28	1.09	1.38	1.38	1.42
7	K1T1	--	1.40	1.56	1.45	1.40	1.51	1.55	1.56
8	K1T2	--	1.40	1.63	1.40	1.14	1.48	1.54	1.63
9	KIT3	--	1.16	1.38	1.24	1.07	1.34	1.40	1.38
10	K1C1	1.44	1.24	1.48					
11	K1C2	1.26	1.15	1.51					
12	K1C3	1.36	1.30	1.39					
13	K2T1	1.43	1.45	1.64					
14	K2T2	1.56	1.21	1.52					
15	K2T3	1.38	1.26	1.47					
16	K2C1	--	1.13	1.44	--	1.13	1.37	1.52	1.44
17	K2C2	--	0.97	1.43	1.40	0.97	1.28	1.41	1.43
18	K2C3	--	0.82	1.40	1.17	0.82	1.29	1.49	1.40
19	K3T1	1.57	1.35	1.55					
20	K3T2	1.43	1.21	1.40					
21	K3T1A	1.50	1.50	1.70					
22	K3C1	1.49	1.34	1.55					
23	K3C2	1.53	1.32	1.57					
24	P1T1	1.25	1.12	1.36	1.26	1.12	1.26	1.47	1.36
25	P1T2	1.20	1.18	1.35	1.17	1.18	1.35	1.49	1.35
26	P1T3	1.26	1.11	1.16	1.15	1.11	1.24	1.38	1.16
27	P1T3A	1.34	1.19	1.26					
28	P1C1	1.40	1.02	1.32	1.16	1.02	1.42	1.41	1.32
29	P1C2	1.19	1.04	1.32	1.14	1.04	1.38	1.41	1.32
30	P1C3	1.17	0.91	1.31	1.10	0.91	1.25	1.36	1.31
31	P2T1	1.32	0.84	1.39					
32	P2T2	1.31	0.90	1.23					
33	P2C1	1.15	--	1.22					
34	P2C2	1.30	--	1.35					
35	P3T1	--	0.87	1.31					
36	P3T2	--	0.80	1.39					
37	P3C1	1.13	1.13	1.46					
38	P3C2	1.03	1.12	1.40					

Bulk Density (g/m3) (CNP Portaprobe) 25 cm depth SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	1.45	1.39	1.49	1.32	1.39	1.40	1.51	1.49
2	EIT2	1.44	1.35	1.38	1.33	1.39	1.38	1.48	1.38
3	E1T3	1.50	1.27	1.41	1.29	1.27	1.36	1.46	1.41
4	E1C1	1.45	1.33	1.60	1.40	1.33	1.48	1.53	1.60
5	E1C2	1.51	1.27	--	1.38	1.27	1.42	1.58	--
6	E1C3	1.44	1.18	1.45	1.33	1.18	1.43	1.43	1.45
7	K1T1	--	1.46	1.60	1.50	1.46	1.58	1.63	1.60
8	K1T2	--	1.48	1.70	1.48	1.18	1.54	1.58	1.70
9	KIT3	--	1.24	1.43	1.33	1.12	1.39	1.45	1.43
10	K1C1	1.48	1.31	1.50					
11	K1C2	1.30	1.22	1.55					
12	K1C3	1.41	1.39	1.42					
13	K2T1	1.44	1.47	1.70					
14	K2T2	1.61	1.34	1.56					
15	K2T3	1.43	1.29	1.50					
16	K2C1	--	1.18	1.47	--	1.18	1.42	1.58	1.47
17	K2C2	--	1.05	1.39	1.47	1.05	1.33	1.42	1.39
18	K2C3	--	0.92	1.42	1.23	0.92	1.33	1.51	1.42
19	K3T1	1.61	1.38	1.60					
20	K3T2	1.42	1.27	1.43					
21	K3T1A	1.54	1.56	1.74					
22	K3C1	1.54	1.44	1.61					
23	K3C2	1.58	1.42	1.60					
24	P1T1	1.24	1.20	1.43	1.32	1.20	1.33	1.49	1.43
25	P1T2	1.24	1.21	1.40	1.16	1.21	1.39	1.47	1.40
26	P1T3	1.28	1.13	1.22	1.19	1.13	1.28	1.40	1.22
27	P1T3A	1.36	1.28	1.30					
28	P1C1	1.42	1.08	1.37	1.19	1.08	1.46	1.48	1.37
29	P1C2	1.25	1.04	1.36	1.19	1.04	1.39	1.45	1.36
30	P1C3	1.21	0.98	1.37	1.17	0.98	1.27	1.42	1.37
31	P2T1	1.38	0.99	1.45					
32	P2T2	1.36	0.99	1.26					
33	P2C1	1.17	--	1.31					
34	P2C2	1.23	--	1.38					
35	P3T1	--	0.94	1.36					
36	P3T2	--	0.80	1.42					
37	P3C1	1.13	1.31	1.49					
38	P3C2	1.06	1.15	1.43					

Bulk Density (g/m3) (CNP Portaprobe) 30 cm depth SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	1.47	1.44	1.50	1.32	1.44	1.40	1.52	1.50
2	EIT2	N/A	1.40	1.41	1.39	1.44	1.39	1.53	1.41
3	E1T3	1.52	1.34	1.43	1.33	1.34	1.38	1.48	1.43
4	E1C1	1.48	1.27	1.61	1.45	1.27	1.51	1.52	1.61
5	E1C2	1.55	1.21	--	1.43	1.21	1.41	1.57	--
6	E1C3	1.42	1.33	1.46	1.37	1.33	1.45	1.45	1.46
7	K1T1	--	1.55	1.61	1.49	1.55	1.59	1.65	1.61
8	K1T2	--	1.50	1.73	1.35	1.20	1.61	1.66	1.73
9	KIT3	--	1.25	1.46	1.31	1.11	1.38	1.49	1.46
10	K1C1	1.53	1.33	1.47					
11	K1C2	1.26	1.22	1.50					
12	K1C3	1.39	1.38	1.41					
13	K2T1	1.43	1.42	1.71					
14	K2T2	1.64	1.36	1.55					
15	K2T3	1.40	1.32	1.48					
16	K2C1	--	1.21	1.48	--	1.21	1.40	1.60	1.48
17	K2C2	--	1.15	1.38	1.50	1.15	1.31	1.41	1.38
18	K2C3	--	0.94	1.35	1.24	0.94	1.38	1.50	1.35
19	K3T1	1.62	1.48	1.62					
20	K3T2	1.35	1.32	1.43					
21	K3T1A	1.56	1.64	1.74					
22	K3C1	1.57	1.47	1.60					
23	K3C2	1.58	1.49	1.65					
24	P1T1	1.24	1.22	1.44	1.32	1.22	1.36	1.46	1.44
25	P1T2	1.27	1.23	1.40	1.16	1.23	1.38	1.51	1.40
26	P1T3	1.27	1.18	1.19	1.23	1.18	1.26	1.36	1.19
27	P1T3A	1.38	1.26	1.29					
28	P1C1	1.41	1.05	1.39	1.19	1.05	1.49	1.46	1.39
29	P1C2	1.28	1.01	1.32	1.16	1.01	1.39	1.46	1.32
30	P1C3	1.21	0.96	1.31	1.15	0.96	1.24	1.38	1.31
31	P2T1	1.36	1.04	1.46					
32	P2T2	1.38	1.02	1.31					
33	P2C1	1.18	--	1.36					
34	P2C2	1.33	--	1.40					
35	P3T1	--	0.93	1.34					
36	P3T2	--	0.82	1.40					
37	P3C1	1.18	1.26	1.48					
38	P3C2	0.99	1.18	1.43					

Soil Moisture Content 0–30 cm (CNP Portaprobe) SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	0.43	0.21	0.21	0.69	0.21	0.29	0.28	
2	EIT2	0.34	0.18	0.21	0.29	0.21	0.27	0.30	0.21
3	E1T3	0.39	0.22	0.21	0.25	0.22	0.29	0.32	0.21
4	E1C1	0.35	0.28	0.27	0.23	0.28	0.28	0.29	0.27
5	E1C2	0.37	0.25	--	0.21	0.25	0.26	0.24	--
6	E1C3	0.34	0.25	0.25	0.25	0.25	0.32	0.28	0.25
7	K1T1	--	0.30	0.22	0.28	0.30	0.23	0.20	0.22
8	K1T2	--	0.30	0.21	0.32	0.25	0.25	0.19	0.21
9	KIT3	--	0.46	0.29	0.34	0.38	0.38	0.25	0.29
10	K1C1	0.37	0.31	0.12	N/A				
11	K1C2	0.38	0.36	0.15	N/A				
12	K1C3	0.34	0.38	0.14	N/A				
13	K2T1	0.39	0.29	0.21	N/A				
14	K2T2	0.34	0.41	0.20	N/A				
15	K2T3	0.38	0.37	0.20	N/A				
16	K2C1	--	0.30	0.19	--	0.30	0.19	0.23	0.19
17	K2C2	--	0.40	0.24	0.30	0.40	0.40	0.29	0.24
18	K2C3	--	0.46	0.20	0.43	0.46	0.31	0.21	0.20
19	K3T1	0.45	0.30	0.28	N/A	N/A	N/A	N/A	N/A
20	K3T2	0.41	0.37	0.32	N/A	N/A	N/A	N/A	N/A
21	K3T1A	0.35	0.21	0.26	N/A	N/A	N/A	N/A	N/A
22	K3C1	0.32	0.30	0.17	N/A	N/A	N/A	N/A	N/A
23	K3C2	0.39	0.33	0.19	N/A	N/A	N/A	N/A	N/A
24	P1T1	0.33	0.37	0.28	0.17	0.37	0.36	0.19	0.28
25	P1T2	0.35	0.36	0.28	0.21	0.36	0.41	0.21	0.28
26	P1T3	0.34	0.43	0.32	0.26	0.43	0.45	0.20	0.32
27	P1T3A	0.40	0.35	0.31	N/A	N/A	N/A	N/A	N/A
28	P1C1	0.18	0.36	0.13	0.13	0.36	0.36	0.23	0.13
29	P1C2	0.23	0.38	0.14	0.15	0.38	0.37	0.23	0.14
30	P1C3	0.24	0.43	0.17	0.23	0.43	0.42	0.24	0.17
31	P2T1	0.37	0.35	0.20	N/A	N/A	N/A	N/A	N/A
32	P2T2	0.41	0.37	0.32	N/A	N/A	N/A	N/A	N/A
33	P2C1	0.18	--	0.33	N/A	N/A	N/A	N/A	N/A
34	P2C2	0.30	--	0.33	N/A	N/A	N/A	N/A	N/A
35	P3T1	--	0.30	0.22	N/A	N/A	N/A	N/A	N/A
36	P3T2	--	0.24	0.25	N/A	N/A	N/A	N/A	N/A
37	P3C1	0.20	0.40	0.16	N/A	N/A	N/A	N/A	N/A
38	P3C2	0.13	0.39	0.18	N/A	N/A	N/A	N/A	N/A

Average Bulk Density (g/m3) 0–15 cm (Ring Method) SWEEP Benchmarks – Annual Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	1.47	1.27	1.26					
2	EIT2	1.40	1.20	1.28	N/A	N/A	N/A	N/A	N/A
3	E1T3	1.38	1.08	1.14	N/A	N/A	N/A	N/A	N/A
4	E1C1	1.44	1.51	1.50	N/A	N/A	N/A	N/A	N/A
5	E1C2	1.50	1.51	––	N/A	N/A	N/A	N/A	N/A
6	E1C3	1.41	1.46	1.42	N/A	N/A	N/A	N/A	N/A
7	K1T1	1.24	1.52	1.44	N/A	N/A	N/A	N/A	N/A
8	K1T2	1.50	1.49	1.52	N/A	N/A	N/A	N/A	N/A
9	KIT3	1.28	1.39	1.49	N/A	N/A	N/A	N/A	N/A
10	K1C1	1.35	1.42	1.41	N/A	N/A	N/A	N/A	N/A
11	K1C2	1.56	1.19	1.55	N/A	N/A	N/A	N/A	N/A
12	K1C3	1.25	1.42	1.35	N/A	N/A	N/A	N/A	N/A
13	K2T1	1.53	1.58	1.64	N/A	N/A	N/A	N/A	N/A
14	K2T2	1.59	1.52	1.45	N/A	N/A	N/A	N/A	N/A
15	K2T3	1.26	1.45	1.54	N/A	N/A	N/A	N/A	N/A
16	K2C1	1.41	1.40	1.41	N/A	N/A	N/A	N/A	N/A
17	K2C2	1.34	1.28	1.21	N/A	N/A	N/A	N/A	N/A
18	K2C3	1.38	1.17	1.35	N/A	N/A	N/A	N/A	N/A
19	K3T1	1.55	1.44	1.42	N/A	N/A	N/A	N/A	N/A
20	K3T2	1.35	1.36	1.39	N/A	N/A	N/A	N/A	N/A
21	K3T1A	1.54	1.43	1.70	N/A	N/A	N/A	N/A	N/A
22	K3C1	1.44	1.34	1.34	N/A	N/A	N/A	N/A	N/A
23	K3C2	1.46	1.46	1.34	N/A	N/A	N/A	N/A	N/A
24	P1T1	1.42	1.43	1.32	N/A	N/A	N/A	N/A	N/A
25	P1T2	1.40	1.37	1.51	N/A	N/A	N/A	N/A	N/A
26	P1T3	1.29	1.34	1.37	N/A	N/A	N/A	N/A	N/A
27	P1T3A	1.26	1.32	1.40	N/A	N/A	N/A	N/A	N/A
28	P1C1	1.28	1.12	1.31	N/A	N/A	N/A	N/A	N/A
29	P1C2	1.39	1.17	1.29	N/A	N/A	N/A	N/A	N/A
30	P1C3	1.27	1.11	1.18	N/A	N/A	N/A	N/A	N/A
31	P2T1	1.40	1.39	1.33	N/A	N/A	N/A	N/A	N/A
32	P2T2	1.30	1.22	1.35	N/A	N/A	N/A	N/A	N/A
33	P2C1	1.42	––	1.58	N/A	N/A	N/A	N/A	N/A
34	P2C2	1.36	––	1.43	N/A	N/A	N/A	N/A	N/A
35	P3T1	1.39	1.06	1.26	N/A	N/A	N/A	N/A	N/A
36	P3T2	1.41	1.27	1.39	N/A	N/A	N/A	N/A	N/A
37	P3C1	1.85	1.39	1.45	N/A	N/A	N/A	N/A	N/A
38	P3C2	1.86	1.31	1.16	N/A	N/A	N/A	N/A	N/A

Average Bulk Density (g/m3) 15–30 cm (Ring Method) SWEEP Benchmarks – Annual Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	1.60	1.56	1.52	N/A	N/A	N/A	N/A	N/A
2	EIT2	1.56	1.39	1.67	N/A	N/A	N/A	N/A	N/A
3	E1T3	1.50	1.50	1.69	N/A	N/A	N/A	N/A	N/A
4	E1C1	1.48	1.56	1.64	N/A	N/A	N/A	N/A	N/A
5	E1C2	1.60	1.49	--	N/A	N/A	N/A	N/A	N/A
6	E1C3	1.53	1.50	1.84	N/A	N/A	N/A	N/A	N/A
7	K1T1	1.66	1.75	1.73	N/A	N/A	N/A	N/A	N/A
8	K1T2	1.66	1.76	1.75	N/A	N/A	N/A	N/A	N/A
9	KIT3	1.44	1.52	1.46	N/A	N/A	N/A	N/A	N/A
10	K1C1	1.47	1.37	1.66	N/A	N/A	N/A	N/A	N/A
11	K1C2	1.58	1.59	1.69	N/A	N/A	N/A	N/A	N/A
12	K1C3	1.50	1.44	1.41	N/A	N/A	N/A	N/A	N/A
13	K2T1	1.63	1.44	1.70	N/A	N/A	N/A	N/A	N/A
14	K2T2	1.49	1.48	1.53	N/A	N/A	N/A	N/A	N/A
15	K2T3	1.48	1.49	1.44	N/A	N/A	N/A	N/A	N/A
16	K2C1	1.55	1.60	1.63	N/A	N/A	N/A	N/A	N/A
17	K2C2	1.37	1.36	1.35	N/A	N/A	N/A	N/A	N/A
18	K2C3	1.47	1.45	1.53	N/A	N/A	N/A	N/A	N/A
19	K3T1	1.59	1.53	1.62	N/A	N/A	N/A	N/A	N/A
20	K3T2	1.41	1.56	1.46	N/A	N/A	N/A	N/A	N/A
21	K3T1A	1.64	1.69	2.00	N/A	N/A	N/A	N/A	N/A
22	K3C1	1.58	1.44	1.74	N/A	N/A	N/A	N/A	N/A
23	K3C2	1.54	1.52	1.54	N/A	N/A	N/A	N/A	N/A
24	P1T1	1.57	1.60	1.49	N/A	N/A	N/A	N/A	N/A
25	P1T2	1.42	1.63	1.56	N/A	N/A	N/A	N/A	N/A
26	P1T3	1.42	1.60	1.29	N/A	N/A	N/A	N/A	N/A
27	P1T3A	1.43	1.55	1.36	N/A	N/A	N/A	N/A	N/A
28	P1C1	1.41	1.38	1.47	N/A	N/A	N/A	N/A	N/A
29	P1C2	1.41	1.44	1.33	N/A	N/A	N/A	N/A	N/A
30	P1C3	1.34	1.52	1.36	N/A	N/A	N/A	N/A	N/A
31	P2T1	1.65	1.44	1.52	N/A	N/A	N/A	N/A	N/A
32	P2T2	1.38	1.47	1.22	N/A	N/A	N/A	N/A	N/A
33	P2C1	1.44	--	1.80	N/A	N/A	N/A	N/A	N/A
34	P2C2	1.47	--	1.49	N/A	N/A	N/A	N/A	N/A
35	P3T1	1.43	1.16	1.43	N/A	N/A	N/A	N/A	N/A
36	P3T2	1.54	1.64	1.40	N/A	N/A	N/A	N/A	N/A
37	P3C1	1.94	1.52	1.26	N/A	N/A	N/A	N/A	N/A
38	P3C2	1.93	1.51	1.41	N/A	N/A	N/A	N/A	N/A

Particle Size Distribution (Calgon Dispersed) % Gravel SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre-plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	1.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
2	EIT2	1.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
3	E1T3	1.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
4	E1C1	1.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
5	E1C2	1.00	0.00	--	N/A	N/A	N/A	N/A	N/A
6	E1C3	1.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
7	K1T1	2.00	--	0.00	N/A	N/A	N/A	N/A	N/A
8	K1T2	1.00	--	0.00	N/A	N/A	N/A	N/A	N/A
9	KIT3	1.00	--	0.00	N/A	N/A	N/A	N/A	N/A
10	K1C1	1.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
11	K1C2	1.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
12	K1C3	1.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
13	K2T1	1.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
14	K2T2	0.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
15	K2T3	1.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
16	K2C1	4.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
17	K2C2	1.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
18	K2C3	0.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
19	K3T1	0.00	--	0.00	N/A	N/A	N/A	N/A	N/A
20	K3T2	1.00	--	0.00	N/A	N/A	N/A	N/A	N/A
21	K3T1A	1.00	--	0.00	N/A	N/A	N/A	N/A	N/A
22	K3C1	0.00	--	0.00	N/A	N/A	N/A	N/A	N/A
23	K3C2	0.00	--	0.00	N/A	N/A	N/A	N/A	N/A
24	P1T1	5.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
25	P1T2	4.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
26	P1T3	1.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
27	P1T3A	1.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
28	P1C1	3.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
29	P1C2	1.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
30	P1C3	2.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
31	P2T1	2.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
32	P2T2	3.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
33	P2C1	8.00	--	0.00	N/A	N/A	N/A	N/A	N/A
34	P2C2	5.00	--	0.00	N/A	N/A	N/A	N/A	N/A
35	P3T1	2.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
36	P3T2	1.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
37	P3C1	2.00	--	0.00	N/A	N/A	N/A	N/A	N/A
38	P3C2	1.00	--	0.00	N/A	N/A	N/A	N/A	N/A

Particle Size Distribution (Calgon Dispersed) % Very Coarse Sand SWEEP Benchmarks – Annual and Seasonal D

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	1.00	0.60	1.50	N/A	N/A	N/A	N/A	N/A
2	EIT2	0.00	0.80	1.60	N/A	N/A	N/A	N/A	N/A
3	E1T3	1.00	1.50	0.70	N/A	N/A	N/A	N/A	N/A
4	E1C1	1.00	0.90	1.20	N/A	N/A	N/A	N/A	N/A
5	E1C2	1.00	0.50	--	N/A	N/A	N/A	N/A	N/A
6	E1C3	1.00	0.40	1.30	N/A	N/A	N/A	N/A	N/A
7	K1T1	1.00	--	0.50	N/A	N/A	N/A	N/A	N/A
8	K1T2	1.00	--	0.40	N/A	N/A	N/A	N/A	N/A
9	KIT3	0.00	--	0.30	N/A	N/A	N/A	N/A	N/A
10	K1C1	1.00	1.00	0.80	N/A	N/A	N/A	N/A	N/A
11	K1C2	0.00	0.60	0.40	N/A	N/A	N/A	N/A	N/A
12	K1C3	1.00	0.70	0.30	N/A	N/A	N/A	N/A	N/A
13	K2T1	1.00	0.00	0.60	N/A	N/A	N/A	N/A	N/A
14	K2T2	0.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A
15	K2T3	0.00	0.20	0.30	N/A	N/A	N/A	N/A	N/A
16	K2C1	1.00	0.60	0.50	N/A	N/A	N/A	N/A	N/A
17	K2C2	0.00	0.00	0.60	N/A	N/A	N/A	N/A	N/A
18	K2C3	0.00	0.00	0.20	N/A	N/A	N/A	N/A	N/A
19	K3T1	0.00	--	0.30	N/A	N/A	N/A	N/A	N/A
20	K3T2	1.00	--	0.50	N/A	N/A	N/A	N/A	N/A
21	K3T1A	1.00	--	1.20	N/A	N/A	N/A	N/A	N/A
22	K3C1	1.00	--	0.40	N/A	N/A	N/A	N/A	N/A
23	K3C2	0.00	--	0.60	N/A	N/A	N/A	N/A	N/A
24	P1T1	2.00	0.80	1.20	N/A	N/A	N/A	N/A	N/A
25	P1T2	1.00	0.60	0.40	N/A	N/A	N/A	N/A	N/A
26	P1T3	1.00	0.40	0.70	N/A	N/A	N/A	N/A	N/A
27	P1T3A	0.00	0.30	0.50	N/A	N/A	N/A	N/A	N/A
28	P1C1	1.00	0.90	0.50	N/A	N/A	N/A	N/A	N/A
29	P1C2	0.00	0.60	0.50	N/A	N/A	N/A	N/A	N/A
30	P1C3	1.00	0.20	0.90	N/A	N/A	N/A	N/A	N/A
31	P2T1	1.00	1.00	0.60	N/A	N/A	N/A	N/A	N/A
32	P2T2	1.00	2.90	2.00	N/A	N/A	N/A	N/A	N/A
33	P2C1	1.00	--	0.60	N/A	N/A	N/A	N/A	N/A
34	P2C2	0.00	--	1.60	N/A	N/A	N/A	N/A	N/A
35	P3T1	1.00	0.90	1.60	N/A	N/A	N/A	N/A	N/A
36	P3T2	2.00	1.10	1.20	N/A	N/A	N/A	N/A	N/A
37	P3C1	0.00	--	0.70	N/A	N/A	N/A	N/A	N/A
38	P3C2	1.00	--	0.50	N/A	N/A	N/A	N/A	N/A

Particle Size Distribution (Calgon Dispersed) % Coarse Sand SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	2.00	1.40	3.50	N/A	N/A	N/A	N/A	N/A
2	EIT2	1.00	1.50	2.80	N/A	N/A	N/A	N/A	N/A
3	E1T3	1.00	1.70	1.00	N/A	N/A	N/A	N/A	N/A
4	E1C1	2.00	1.40	1.90	N/A	N/A	N/A	N/A	N/A
5	E1C2	3.00	1.40	--	N/A	N/A	N/A	N/A	N/A
6	E1C3	1.00	1.20	1.70	N/A	N/A	N/A	N/A	N/A
7	K1T1	2.00	--	1.40	N/A	N/A	N/A	N/A	N/A
8	K1T2	1.00	--	1.20	N/A	N/A	N/A	N/A	N/A
9	KIT3	1.00	--	0.80	N/A	N/A	N/A	N/A	N/A
10	K1C1	2.00	1.20	2.10	N/A	N/A	N/A	N/A	N/A
11	K1C2	1.00	0.70	2.10	N/A	N/A	N/A	N/A	N/A
12	K1C3	1.00	0.70	1.60	N/A	N/A	N/A	N/A	N/A
13	K2T1	1.00	1.10	1.10	N/A	N/A	N/A	N/A	N/A
14	K2T2	1.00	0.70	0.70	N/A	N/A	N/A	N/A	N/A
15	K2T3	1.00	1.20	1.40	N/A	N/A	N/A	N/A	N/A
16	K2C1	1.00	1.00	1.40	N/A	N/A	N/A	N/A	N/A
17	K2C2	1.00	0.40	0.90	N/A	N/A	N/A	N/A	N/A
18	K2C3	0.00	0.40	1.00	N/A	N/A	N/A	N/A	N/A
19	K3T1	1.00	--	1.00	N/A	N/A	N/A	N/A	N/A
20	K3T2	1.00	--	1.00	N/A	N/A	N/A	N/A	N/A
21	K3T1A	1.00	--	1.50	N/A	N/A	N/A	N/A	N/A
22	K3C1	1.00	--	1.40	N/A	N/A	N/A	N/A	N/A
23	K3C2	1.00	--	1.70	N/A	N/A	N/A	N/A	N/A
24	P1T1	3.00	2.50	3.30	N/A	N/A	N/A	N/A	N/A
25	P1T2	3.00	1.90	1.50	N/A	N/A	N/A	N/A	N/A
26	P1T3	2.00	1.50	2.50	N/A	N/A	N/A	N/A	N/A
27	P1T3A	2.00	1.50	1.80	N/A	N/A	N/A	N/A	N/A
28	P1C1	1.00	1.50	2.20	N/A	N/A	N/A	N/A	N/A
29	P1C2	1.00	1.10	1.50	N/A	N/A	N/A	N/A	N/A
30	P1C3	2.00	1.00	3.00	N/A	N/A	N/A	N/A	N/A
31	P2T1	3.00	2.30	2.90	N/A	N/A	N/A	N/A	N/A
32	P2T2	3.00	2.70	5.90	N/A	N/A	N/A	N/A	N/A
33	P2C1	2.00	--	2.40	N/A	N/A	N/A	N/A	N/A
34	P2C2	2.00	--	3.70	N/A	N/A	N/A	N/A	N/A
35	P3T1	2.00	1.90	3.60	N/A	N/A	N/A	N/A	N/A
36	P3T2	2.00	2.20	3.20	N/A	N/A	N/A	N/A	N/A
37	P3C1	1.00	--	1.70	N/A	N/A	N/A	N/A	N/A
38	P3C2	1.00	--	1.80	N/A	N/A	N/A	N/A	N/A

Particle Size Distribution (Calgon Dispersed) % Medium Sand SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	6.00	5.10	5.00	N/A	N/A	N/A	N/A	N/A
2	EIT2	5.00	5.20	5.20	N/A	N/A	N/A	N/A	N/A
3	E1T3	5.00	5.80	1.20	N/A	N/A	N/A	N/A	N/A
4	E1C1	5.00	5.90	5.90	N/A	N/A	N/A	N/A	N/A
5	E1C2	8.00	6.30	--	N/A	N/A	N/A	N/A	N/A
6	E1C3	5.00	5.10	5.80	N/A	N/A	N/A	N/A	N/A
7	K1T1	3.00	--	2.70	N/A	N/A	N/A	N/A	N/A
8	K1T2	2.00	--	2.30	N/A	N/A	N/A	N/A	N/A
9	KIT3	2.00	--	1.40	N/A	N/A	N/A	N/A	N/A
10	K1C1	3.00	2.70	2.80	N/A	N/A	N/A	N/A	N/A
11	K1C2	5.00	2.60	4.50	N/A	N/A	N/A	N/A	N/A
12	K1C3	3.00	2.50	2.60	N/A	N/A	N/A	N/A	N/A
13	K2T1	2.00	5.90	4.50	N/A	N/A	N/A	N/A	N/A
14	K2T2	11.00	12.00	10.40	N/A	N/A	N/A	N/A	N/A
15	K2T3	12.00	12.10	13.00	N/A	N/A	N/A	N/A	N/A
16	K2C1	2.00	1.90	2.10	N/A	N/A	N/A	N/A	N/A
17	K2C2	2.00	1.40	2.10	N/A	N/A	N/A	N/A	N/A
18	K2C3	1.00	1.60	2.10	N/A	N/A	N/A	N/A	N/A
19	K3T1	3.00	--	2.70	N/A	N/A	N/A	N/A	N/A
20	K3T2	3.00	--	2.60	N/A	N/A	N/A	N/A	N/A
21	K3T1A	4.00	--	3.10	N/A	N/A	N/A	N/A	N/A
22	K3C1	2.00	--	1.80	N/A	N/A	N/A	N/A	N/A
23	K3C2	2.00	--	2.10	N/A	N/A	N/A	N/A	N/A
24	P1T1	7.00	7.70	8.20	N/A	N/A	N/A	N/A	N/A
25	P1T2	8.00	7.40	5.30	N/A	N/A	N/A	N/A	N/A
26	P1T3	6.00	5.60	7.80	N/A	N/A	N/A	N/A	N/A
27	P1T3A	6.00	6.00	5.90	N/A	N/A	N/A	N/A	N/A
28	P1C1	3.00	3.10	3.50	N/A	N/A	N/A	N/A	N/A
29	P1C2	3.00	4.10	2.60	N/A	N/A	N/A	N/A	N/A
30	P1C3	4.00	2.50	4.30	N/A	N/A	N/A	N/A	N/A
31	P2T1	6.00	6.80	7.20	N/A	N/A	N/A	N/A	N/A
32	P2T2	8.00	6.00	6.40	N/A	N/A	N/A	N/A	N/A
33	P2C1	8.00	--	8.50	N/A	N/A	N/A	N/A	N/A
34	P2C2	9.00	--	8.30	N/A	N/A	N/A	N/A	N/A
35	P3T1	6.00	5.60	5.80	N/A	N/A	N/A	N/A	N/A
36	P3T2	6.00	6.20	6.60	N/A	N/A	N/A	N/A	N/A
37	P3C1	5.00	--	5.80	N/A	N/A	N/A	N/A	N/A
38	P3C2	5.00	--	4.60	N/A	N/A	N/A	N/A	N/A

Particle Size Distribution (Calgon Dispersed) % Fine Sand SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	13.00	15.20	10.70	N/A	N/A	N/A	N/A	N/A
2	EIT2	12.00	13.20	11.70	N/A	N/A	N/A	N/A	N/A
3	E1T3	12.00	14.30	3.20	N/A	N/A	N/A	N/A	N/A
4	E1C1	15.00	13.70	18.10	N/A	N/A	N/A	N/A	N/A
5	E1C2	17.00	12.50	––	N/A	N/A	N/A	N/A	N/A
6	E1C3	11.00	12.60	13.70	N/A	N/A	N/A	N/A	N/A
7	K1T1	5.00	––	4.80	N/A	N/A	N/A	N/A	N/A
8	K1T2	4.00	––	3.60	N/A	N/A	N/A	N/A	N/A
9	KIT3	3.00	––	2.80	N/A	N/A	N/A	N/A	N/A
10	K1C1	6.00	5.80	4.80	N/A	N/A	N/A	N/A	N/A
11	K1C2	13.00	6.40	10.40	N/A	N/A	N/A	N/A	N/A
12	K1C3	6.00	6.40	4.60	N/A	N/A	N/A	N/A	N/A
13	K2T1	4.00	10.40	8.60	N/A	N/A	N/A	N/A	N/A
14	K2T2	27.00	25.60	27.90	N/A	N/A	N/A	N/A	N/A
15	K2T3	26.00	25.80	26.20	N/A	N/A	N/A	N/A	N/A
16	K2C1	4.00	3.70	3.40	N/A	N/A	N/A	N/A	N/A
17	K2C2	4.00	2.90	2.40	N/A	N/A	N/A	N/A	N/A
18	K2C3	3.00	2.70	3.10	N/A	N/A	N/A	N/A	N/A
19	K3T1	5.00	––	4.60	N/A	N/A	N/A	N/A	N/A
20	K3T2	7.00	––	6.80	N/A	N/A	N/A	N/A	N/A
21	K3T1A	7.00	––	5.20	N/A	N/A	N/A	N/A	N/A
22	K3C1	4.00	––	2.80	N/A	N/A	N/A	N/A	N/A
23	K3C2	5.00	––	3.40	N/A	N/A	N/A	N/A	N/A
24	P1T1	16.00	15.40	15.10	N/A	N/A	N/A	N/A	N/A
25	P1T2	14.00	14.90	9.40	N/A	N/A	N/A	N/A	N/A
26	P1T3	10.00	9.70	13.60	N/A	N/A	N/A	N/A	N/A
27	P1T3A	9.00	12.10	9.10	N/A	N/A	N/A	N/A	N/A
28	P1C1	6.00	5.90	5.50	N/A	N/A	N/A	N/A	N/A
29	P1C2	6.00	8.00	4.70	N/A	N/A	N/A	N/A	N/A
30	P1C3	8.00	5.20	6.30	N/A	N/A	N/A	N/A	N/A
31	P2T1	12.00	12.50	12.90	N/A	N/A	N/A	N/A	N/A
32	P2T2	12.00	10.30	8.50	N/A	N/A	N/A	N/A	N/A
33	P2C1	14.00	––	15.00	N/A	N/A	N/A	N/A	N/A
34	P2C2	15.00	––	10.50	N/A	N/A	N/A	N/A	N/A
35	P3T1	10.00	10.70	8.60	N/A	N/A	N/A	N/A	N/A
36	P3T2	9.00	9.20	8.40	N/A	N/A	N/A	N/A	N/A
37	P3C1	10.00	––	8.80	N/A	N/A	N/A	N/A	N/A
38	P3C2	9.00	––	6.30	N/A	N/A	N/A	N/A	N/A

Particle Size Distribution (Calgon Dispersed) % Very Fine Sand SWEEP Benchmarks – Annual and Seasonal Dat

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	8.00	7.40	6.90	N/A	N/A	N/A	N/A	N/A
2	EIT2	7.00	6.70	6.00	N/A	N/A	N/A	N/A	N/A
3	E1T3	7.00	7.00	15.80	N/A	N/A	N/A	N/A	N/A
4	E1C1	8.00	7.30	7.10	N/A	N/A	N/A	N/A	N/A
5	E1C2	8.00	6.60	––	N/A	N/A	N/A	N/A	N/A
6	E1C3	7.00	6.80	7.50	N/A	N/A	N/A	N/A	N/A
7	K1T1	10.00	––	10.20	N/A	N/A	N/A	N/A	N/A
8	K1T2	11.00	––	9.80	N/A	N/A	N/A	N/A	N/A
9	KIT3	19.00	––	14.00	N/A	N/A	N/A	N/A	N/A
10	K1C1	12.00	10.90	9.20	N/A	N/A	N/A	N/A	N/A
11	K1C2	14.00	11.00	9.60	N/A	N/A	N/A	N/A	N/A
12	K1C3	14.00	6.70	10.00	N/A	N/A	N/A	N/A	N/A
13	K2T1	11.00	9.50	8.50	N/A	N/A	N/A	N/A	N/A
14	K2T2	27.00	24.20	23.20	N/A	N/A	N/A	N/A	N/A
15	K2T3	27.00	23.40	21.80	N/A	N/A	N/A	N/A	N/A
16	K2C1	10.00	8.50	8.50	N/A	N/A	N/A	N/A	N/A
17	K2C2	19.00	16.40	12.60	N/A	N/A	N/A	N/A	N/A
18	K2C3	19.00	11.50	11.50	N/A	N/A	N/A	N/A	N/A
19	K3T1	12.00	––	10.90	N/A	N/A	N/A	N/A	N/A
20	K3T2	20.00	––	15.60	N/A	N/A	N/A	N/A	N/A
21	K3T1A	9.00	––	5.40	N/A	N/A	N/A	N/A	N/A
22	K3C1	9.00	––	7.50	N/A	N/A	N/A	N/A	N/A
23	K3C2	16.00	––	10.40	N/A	N/A	N/A	N/A	N/A
24	P1T1	18.00	16.50	16.20	N/A	N/A	N/A	N/A	N/A
25	P1T2	18.00	18.90	12.90	N/A	N/A	N/A	N/A	N/A
26	P1T3	17.00	15.30	15.90	N/A	N/A	N/A	N/A	N/A
27	P1T3A	15.00	16.30	13.70	N/A	N/A	N/A	N/A	N/A
28	P1C1	19.00	14.00	14.40	N/A	N/A	N/A	N/A	N/A
29	P1C2	20.00	15.80	13.40	N/A	N/A	N/A	N/A	N/A
30	P1C3	19.00	16.70	13.80	N/A	N/A	N/A	N/A	N/A
31	P2T1	15.00	14.10	13.00	N/A	N/A	N/A	N/A	N/A
32	P2T2	13.00	11.90	9.70	N/A	N/A	N/A	N/A	N/A
33	P2C1	19.00	––	16.70	N/A	N/A	N/A	N/A	N/A
34	P2C2	23.00	––	12.80	N/A	N/A	N/A	N/A	N/A
35	P3T1	13.00	12.00	10.20	N/A	N/A	N/A	N/A	N/A
36	P3T2	12.00	12.00	10.60	N/A	N/A	N/A	N/A	N/A
37	P3C1	25.00	––	17.80	N/A	N/A	N/A	N/A	N/A
38	P3C2	21.00	––	18.70	N/A	N/A	N/A	N/A	N/A

Particle Size Distribution (Calgon Dispersed) % Sand SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	29.00	29.70	27.60	N/A	N/A	N/A	N/A	N/A
2	EIT2	26.00	27.40	27.30	N/A	N/A	N/A	N/A	N/A
3	E1T3	26.00	30.30	21.90	N/A	N/A	N/A	N/A	N/A
4	E1C1	30.00	29.10	34.10	N/A	N/A	N/A	N/A	N/A
5	E1C2	38.00	27.30	--	N/A	N/A	N/A	N/A	N/A
6	E1C3	25.00	26.10	30.10	N/A	N/A	N/A	N/A	N/A
7	K1T1	21.00	--	19.60	N/A	N/A	N/A	N/A	N/A
8	K1T2	19.00	--	17.40	N/A	N/A	N/A	N/A	N/A
9	KIT3	25.00	--	19.30	N/A	N/A	N/A	N/A	N/A
10	K1C1	24.00	21.60	19.70	N/A	N/A	N/A	N/A	N/A
11	K1C2	34.00	21.20	27.00	N/A	N/A	N/A	N/A	N/A
12	K1C3	25.00	16.90	19.10	N/A	N/A	N/A	N/A	N/A
13	K2T1	19.00	26.80	23.40	N/A	N/A	N/A	N/A	N/A
14	K2T2	66.00	62.60	62.20	N/A	N/A	N/A	N/A	N/A
15	K2T3	67.00	62.70	62.60	N/A	N/A	N/A	N/A	N/A
16	K2C1	17.00	15.70	15.90	N/A	N/A	N/A	N/A	N/A
17	K2C2	26.00	21.10	18.60	N/A	N/A	N/A	N/A	N/A
18	K2C3	24.00	16.10	18.00	N/A	N/A	N/A	N/A	N/A
19	K3T1	20.00	--	19.40	N/A	N/A	N/A	N/A	N/A
20	K3T2	32.00	--	26.50	N/A	N/A	N/A	N/A	N/A
21	K3T1A	22.00	--	16.50	N/A	N/A	N/A	N/A	N/A
22	K3C1	16.00	--	14.00	N/A	N/A	N/A	N/A	N/A
23	K3C2	25.00	--	18.20	N/A	N/A	N/A	N/A	N/A
24	P1T1	46.00	42.90	44.00	N/A	N/A	N/A	N/A	N/A
25	P1T2	44.00	43.80	29.60	N/A	N/A	N/A	N/A	N/A
26	P1T3	35.00	32.60	40.50	N/A	N/A	N/A	N/A	N/A
27	P1T3A	33.00	36.20	31.10	N/A	N/A	N/A	N/A	N/A
28	P1C1	30.00	25.40	26.20	N/A	N/A	N/A	N/A	N/A
29	P1C2	30.00	29.60	22.70	N/A	N/A	N/A	N/A	N/A
30	P1C3	34.00	25.70	28.20	N/A	N/A	N/A	N/A	N/A
31	P2T1	38.00	36.60	36.60	N/A	N/A	N/A	N/A	N/A
32	P2T2	36.00	33.80	32.50	N/A	N/A	N/A	N/A	N/A
33	P2C1	44.00	--	43.30	N/A	N/A	N/A	N/A	N/A
34	P2C2	49.00	--	36.80	N/A	N/A	N/A	N/A	N/A
35	P3T1	32.00	31.10	29.80	N/A	N/A	N/A	N/A	N/A
36	P3T2	30.00	30.80	29.90	N/A	N/A	N/A	N/A	N/A
37	P3C1	42.00	--	34.80	N/A	N/A	N/A	N/A	N/A
38	P3C2	38.00	--	32.00	N/A	N/A	N/A	N/A	N/A

Particle Size Distribution (Calgon Dispersed) % Silt SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	36.00	36.40	36.90	N/A	N/A	N/A	N/A	N/A
2	EIT2	35.00	38.20	35.30	N/A	N/A	N/A	N/A	N/A
3	E1T3	34.00	36.10	36.10	N/A	N/A	N/A	N/A	N/A
4	E1C1	36.00	35.70	34.20	N/A	N/A	N/A	N/A	N/A
5	E1C2	30.00	35.10	--	N/A	N/A	N/A	N/A	N/A
6	E1C3	40.00	33.70	40.90	N/A	N/A	N/A	N/A	N/A
7	K1T1	51.00	--	55.80	N/A	N/A	N/A	N/A	N/A
8	K1T2	54.00	--	57.80	N/A	N/A	N/A	N/A	N/A
9	KIT3	57.00	--	63.70	N/A	N/A	N/A	N/A	N/A
10	K1C1	53.00	54.60	54.90	N/A	N/A	N/A	N/A	N/A
11	K1C2	43.00	55.90	47.60	N/A	N/A	N/A	N/A	N/A
12	K1C3	52.00	49.30	56.20	N/A	N/A	N/A	N/A	N/A
13	K2T1	54.00	41.80	43.50	N/A	N/A	N/A	N/A	N/A
14	K2T2	24.00	25.70	29.00	N/A	N/A	N/A	N/A	N/A
15	K2T3	22.00	25.40	26.90	N/A	N/A	N/A	N/A	N/A
16	K2C1	50.00	51.70	58.70	N/A	N/A	N/A	N/A	N/A
17	K2C2	54.00	58.80	61.10	N/A	N/A	N/A	N/A	N/A
18	K2C3	58.00	62.10	62.60	N/A	N/A	N/A	N/A	N/A
19	K3T1	50.00	--	51.50	N/A	N/A	N/A	N/A	N/A
20	K3T2	44.00	--	52.30	N/A	N/A	N/A	N/A	N/A
21	K3T1A	48.00	--	51.70	N/A	N/A	N/A	N/A	N/A
22	K3C1	53.00	--	56.80	N/A	N/A	N/A	N/A	N/A
23	K3C2	51.00	--	57.10	N/A	N/A	N/A	N/A	N/A
24	P1T1	40.00	41.40	42.10	N/A	N/A	N/A	N/A	N/A
25	P1T2	42.00	43.40	56.30	N/A	N/A	N/A	N/A	N/A
26	P1T3	51.00	53.10	46.80	N/A	N/A	N/A	N/A	N/A
27	P1T3A	52.00	50.40	55.30	N/A	N/A	N/A	N/A	N/A
28	P1C1	55.00	59.70	58.60	N/A	N/A	N/A	N/A	N/A
29	P1C2	55.00	55.50	63.40	N/A	N/A	N/A	N/A	N/A
30	P1C3	49.00	60.10	56.50	N/A	N/A	N/A	N/A	N/A
31	P2T1	46.00	47.50	48.10	N/A	N/A	N/A	N/A	N/A
32	P2T2	44.00	47.10	46.40	N/A	N/A	N/A	N/A	N/A
33	P2C1	44.00	--	46.70	N/A	N/A	N/A	N/A	N/A
34	P2C2	40.00	--	48.20	N/A	N/A	N/A	N/A	N/A
35	P3T1	45.00	45.00	47.80	N/A	N/A	N/A	N/A	N/A
36	P3T2	50.00	49.00	50.70	N/A	N/A	N/A	N/A	N/A
37	P3C1	46.00	--	53.00	N/A	N/A	N/A	N/A	N/A
38	P3C2	50.00	--	54.50	N/A	N/A	N/A	N/A	N/A

Particle Size Distribution (Calgon Dispersed) % Clay SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	35.00	33.90	35.60	N/A	N/A	N/A	N/A	N/A
2	EIT2	39.00	34.40	37.40	N/A	N/A	N/A	N/A	N/A
3	E1T3	39.00	33.60	42.00	N/A	N/A	N/A	N/A	N/A
4	E1C1	34.00	35.20	31.70	N/A	N/A	N/A	N/A	N/A
5	E1C2	33.00	37.60	--	N/A	N/A	N/A	N/A	N/A
6	E1C3	35.00	40.20	29.10	N/A	N/A	N/A	N/A	N/A
7	K1T1	28.00	--	24.60	N/A	N/A	N/A	N/A	N/A
8	K1T2	27.00	--	24.70	N/A	N/A	N/A	N/A	N/A
9	KIT3	18.00	--	17.00	N/A	N/A	N/A	N/A	N/A
10	K1C1	23.00	23.90	25.40	N/A	N/A	N/A	N/A	N/A
11	K1C2	23.00	22.90	25.40	N/A	N/A	N/A	N/A	N/A
12	K1C3	23.00	33.70	24.70	N/A	N/A	N/A	N/A	N/A
13	K2T1	27.00	31.40	33.10	N/A	N/A	N/A	N/A	N/A
14	K2T2	10.00	11.80	8.80	N/A	N/A	N/A	N/A	N/A
15	K2T3	11.00	11.90	10.50	N/A	N/A	N/A	N/A	N/A
16	K2C1	33.00	32.60	25.40	N/A	N/A	N/A	N/A	N/A
17	K2C2	20.00	20.10	20.40	N/A	N/A	N/A	N/A	N/A
18	K2C3	19.00	21.80	19.40	N/A	N/A	N/A	N/A	N/A
19	K3T1	30.00	--	29.10	N/A	N/A	N/A	N/A	N/A
20	K3T2	23.00	--	21.10	N/A	N/A	N/A	N/A	N/A
21	K3T1A	30.00	--	31.80	N/A	N/A	N/A	N/A	N/A
22	K3C1	31.00	--	29.20	N/A	N/A	N/A	N/A	N/A
23	K3C2	24.00	--	24.70	N/A	N/A	N/A	N/A	N/A
24	P1T1	14.00	15.80	13.90	N/A	N/A	N/A	N/A	N/A
25	P1T2	13.00	12.80	14.10	N/A	N/A	N/A	N/A	N/A
26	P1T3	15.00	14.20	12.80	N/A	N/A	N/A	N/A	N/A
27	P1T3A	15.00	13.50	13.60	N/A	N/A	N/A	N/A	N/A
28	P1C1	15.00	14.80	15.20	N/A	N/A	N/A	N/A	N/A
29	P1C2	14.00	14.90	13.90	N/A	N/A	N/A	N/A	N/A
30	P1C3	17.00	14.30	15.30	N/A	N/A	N/A	N/A	N/A
31	P2T1	16.00	15.80	15.30	N/A	N/A	N/A	N/A	N/A
32	P2T2	19.00	19.20	21.10	N/A	N/A	N/A	N/A	N/A
33	P2C1	12.00	--	10.10	N/A	N/A	N/A	N/A	N/A
34	P2C2	11.00	--	15.00	N/A	N/A	N/A	N/A	N/A
35	P3T1	23.00	23.80	22.40	N/A	N/A	N/A	N/A	N/A
36	P3T2	20.00	20.30	19.40	N/A	N/A	N/A	N/A	N/A
37	P3C1	11.00	--	12.20	N/A	N/A	N/A	N/A	N/A
38	P3C2	13.00	--	13.50	N/A	N/A	N/A	N/A	N/A

Particle Size Distribution (Water Dispersed) % Gravel SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	N/A	N/A	N/A	--	0.00	0.00	0.00	0.00
2	EIT2	N/A	N/A	N/A	--	0.00	0.00	0.00	0.00
3	E1T3	N/A	N/A	N/A	--	0.00	0.00	0.00	0.00
4	E1C1	N/A	N/A	N/A	--	0.00	0.00	0.00	0.00
5	E1C2	N/A	N/A	N/A	--	0.00	0.00	0.00	--
6	E1C3	N/A	N/A	N/A	--	0.00	0.00	0.00	0.00
7	K1T1	N/A	N/A	N/A	--	--	0.00	0.00	0.00
8	K1T2	N/A	N/A	N/A	--	--	0.00	0.00	0.00
9	KIT3	N/A	N/A	N/A	--	--	0.00	0.00	0.00
16	K2C1	N/A	N/A	N/A	--	0.00	0.00	0.00	0.00
17	K2C2	N/A	N/A	N/A	--	0.00	0.00	0.00	0.00
18	K2C3	N/A	N/A	N/A	--	0.00	0.00	0.00	0.00
24	P1T1	N/A	N/A	N/A	--	0.00	0.00	0.00	0.00
25	P1T2	N/A	N/A	N/A	--	0.00	0.00	0.00	0.00
26	P1T3	N/A	N/A	N/A	--	0.00	0.00	0.00	0.00
28	P1C1	N/A	N/A	N/A	--	0.00	0.00	0.00	0.00
29	P1C2	N/A	N/A	N/A	--	0.00	0.00	0.00	0.00
30	P1C3	N/A	N/A	N/A	--	0.00	0.00	0.00	0.00

Particle Size Distribution (Water Dispersed) % Very Coarse Sand SWEEP Benchmarks – Annual and Seasonal Da

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	N/A	N/A	N/A	--	1.00	0.80	0.80	1.50
2	EIT2	N/A	N/A	N/A	--	1.10	0.50	0.60	1.80
3	E1T3	N/A	N/A	N/A	--	1.60	5.000E–01	0.90	1.80
4	E1C1	N/A	N/A	N/A	--	0.70	0.80	0.80	1.20
5	E1C2	N/A	N/A	N/A	--	1.20	0.90	0.80	--
6	E1C3	N/A	N/A	N/A	--	0.70	0.90	0.90	1.00
7	K1T1	N/A	N/A	N/A	--	--	0.60	1.10	1.00
8	K1T2	N/A	N/A	N/A	--	--	0.40	0.50	0.70
9	KIT3	N/A	N/A	N/A	--	--	0.20	0.10	0.50
16	K2C1	N/A	N/A	N/A	--	0.70	0.30	0.50	0.80
17	K2C2	N/A	N/A	N/A	--	0.20	0.40	0.30	0.40
18	K2C3	N/A	N/A	N/A	--	0.30	0.20	0.20	0.50
24	P1T1	N/A	N/A	N/A	--	1.00	1.30	2.10	1.80
25	P1T2	N/A	N/A	N/A	--	1.50	0.70	1.00	0.30
26	P1T3	N/A	N/A	N/A	--	0.90	0.40	0.40	0.40
28	P1C1	N/A	N/A	N/A	--	1.30	0.50	0.20	0.70
29	P1C2	N/A	N/A	N/A	--	0.60	0.60	0.60	0.30
30	P1C3	N/A	N/A	N/A	--	1.20	0.80	0.20	1.10

Particle Size Distribution (Water Dispersed) % Coarse Sand SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	N/A	N/A	N/A	--	2.40	1.70	2.00	3.00
2	EIT2	N/A	N/A	N/A	--	2.30	1.60	1.60	2.30
3	E1T3	N/A	N/A	N/A	--	3.00	1.600E+00	1.60	2.50
4	E1C1	N/A	N/A	N/A	--	1.90	1.40	1.60	2.00
5	E1C2	N/A	N/A	N/A	--	2.00	1.80	2.00	--
6	E1C3	N/A	N/A	N/A	--	1.60	1.80	1.60	2.30
7	K1T1	N/A	N/A	N/A	--	--	1.00	1.80	1.50
8	K1T2	N/A	N/A	N/A	--	--	0.80	0.90	1.20
9	KIT3	N/A	N/A	N/A	--	--	0.90	0.90	0.90
16	K2C1	N/A	N/A	N/A	--	1.50	0.90	1.10	1.50
17	K2C2	N/A	N/A	N/A	--	1.10	0.80	0.90	0.90
18	K2C3	N/A	N/A	N/A	--	0.80	0.60	0.80	0.80
24	P1T1	N/A	N/A	N/A	--	4.10	2.70	2.60	2.80
25	P1T2	N/A	N/A	N/A	--	4.50	2.20	2.80	2.50
26	P1T3	N/A	N/A	N/A	--	4.00	2.00	1.90	1.50
28	P1C1	N/A	N/A	N/A	--	1.90	1.50	1.40	1.60
29	P1C2	N/A	N/A	N/A	--	1.60	1.10	1.10	1.60
30	P1C3	N/A	N/A	N/A	--	2.30	1.40	1.80	3.00

Particle Size Distribution (Water Dispersed) % Medium Sand SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	N/A	N/A	N/A	--	5.80	5.80	6.10	4.90
2	EIT2	N/A	N/A	N/A	--	5.60	5.60	5.80	4.70
3	E1T3	N/A	N/A	N/A	--	5.20	5.600E+00	4.50	3.40
4	E1C1	N/A	N/A	N/A	--	5.80	5.10	5.00	6.10
5	E1C2	N/A	N/A	N/A	--	4.00	6.20	6.80	--
6	E1C3	N/A	N/A	N/A	--	4.30	5.90	5.30	6.40
7	K1T1	N/A	N/A	N/A	--	--	2.30	2.90	2.60
8	K1T2	N/A	N/A	N/A	--	--	1.90	1.90	2.40
9	KIT3	N/A	N/A	N/A	--	--	1.60	1.80	1.80
16	K2C1	N/A	N/A	N/A	--	2.00	2.10	2.10	2.20
17	K2C2	N/A	N/A	N/A	--	2.10	2.10	2.40	2.50
18	K2C3	N/A	N/A	N/A	--	1.70	2.10	2.00	2.40
24	P1T1	N/A	N/A	N/A	--	9.00	7.30	7.10	7.50
25	P1T2	N/A	N/A	N/A	--	9.40	7.60	9.50	8.30
26	P1T3	N/A	N/A	N/A	--	6.40	5.40	5.60	5.60
28	P1C1	N/A	N/A	N/A	--	2.90	3.60	3.40	3.40
29	P1C2	N/A	N/A	N/A	--	2.80	3.70	2.70	2.70
30	P1C3	N/A	N/A	N/A	--	4.40	4.20	4.70	4.90

Particle Size Distribution (Water Dispersed) % Fine Sand SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
2	EIT2	N/A	N/A	N/A	--	12.90	14.60	14.60	13.30
3	E1T3	N/A	N/A	N/A	--	12.50	1.460E+01	11.20	9.60
4	E1C1	N/A	N/A	N/A	--	13.30	17.00	17.30	18.90
5	E1C2	N/A	N/A	N/A	--	11.40	17.70	17.80	--
6	E1C3	N/A	N/A	N/A	--	11.10	14.70	14.10	15.70
7	K1T1	N/A	N/A	N/A	--	--	5.10	5.30	4.80
8	K1T2	N/A	N/A	N/A	--	--	4.60	3.90	5.20
9	KIT3	N/A	N/A	N/A	--	--	3.40	3.60	3.40
16	K2C1	N/A	N/A	N/A	--	3.90	4.60	4.60	4.60
17	K2C2	N/A	N/A	N/A	--	4.30	5.40	5.20	4.10
18	K2C3	N/A	N/A	N/A	--	4.10	4.70	4.80	4.90
24	P1T1	N/A	N/A	N/A	--	13.20	16.80	15.30	17.10
25	P1T2	N/A	N/A	N/A	--	12.80	15.50	15.70	16.90
26	P1T3	N/A	N/A	N/A	--	8.30	10.90	10.20	10.50
28	P1C1	N/A	N/A	N/A	--	6.10	7.50	7.10	6.70
29	P1C2	N/A	N/A	N/A	--	5.40	7.80	5.60	6.10
30	P1C3	N/A	N/A	N/A	--	7.90	9.30	9.00	7.30

Particle Size Distribution (Water Dispersed) % Very Fine Sand SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	N/A	N/A	N/A	--	6.90	8.00	8.00	8.50
2	EIT2	N/A	N/A	N/A	--	7.00	7.20	8.10	7.30
3	E1T3	N/A	N/A	N/A	--	7.40	7.200E+00	6.80	7.30
4	E1C1	N/A	N/A	N/A	--	7.60	7.40	8.10	7.30
5	E1C2	N/A	N/A	N/A	--	7.80	8.40	7.50	--
6	E1C3	N/A	N/A	N/A	--	7.10	7.70	8.20	7.40
7	K1T1	N/A	N/A	N/A	--	--	9.70	9.20	10.30
8	K1T2	N/A	N/A	N/A	--	--	8.60	10.20	10.10
9	KIT3	N/A	N/A	N/A	--	--	17.30	14.60	14.50
16	K2C1	N/A	N/A	N/A	--	7.90	8.40	10.70	9.00
17	K2C2	N/A	N/A	N/A	--	12.90	15.30	15.30	13.20
18	K2C3	N/A	N/A	N/A	--	11.90	15.70	16.60	12.20
24	P1T1	N/A	N/A	N/A	--	15.70	17.10	16.60	13.90
25	P1T2	N/A	N/A	N/A	--	14.70	16.20	14.20	12.90
26	P1T3	N/A	N/A	N/A	--	14.10	15.10	13.90	11.90
28	P1C1	N/A	N/A	N/A	--	14.40	16.90	14.50	15.40
29	P1C2	N/A	N/A	N/A	--	15.40	21.40	16.10	13.70
30	P1C3	N/A	N/A	N/A	--	14.80	19.50	15.50	13.50

Particle Size Distribution (Water Dispersed) % Sand SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre-plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	N/A	N/A	N/A	--	30.80	30.80	31.70	29.70
2	EIT2	N/A	N/A	N/A	--	28.90	29.50	30.70	29.40
3	E1T3	N/A	N/A	N/A	--	29.70	2.950E+01	24.90	24.50
4	E1C1	N/A	N/A	N/A	--	29.30	31.70	32.90	35.50
5	E1C2	N/A	N/A	N/A	--	26.40	35.00	35.00	--
6	E1C3	N/A	N/A	N/A	--	24.80	31.00	30.10	32.80
7	K1T1	N/A	N/A	N/A	--	--	18.70	20.40	20.10
8	K1T2	N/A	N/A	N/A	--	--	16.40	17.40	19.60
9	KIT3	N/A	N/A	N/A	--	--	23.40	21.10	21.10
16	K2C1	N/A	N/A	N/A	--	16.10	16.30	19.00	18.00
17	K2C2	N/A	N/A	N/A	--	20.60	24.00	24.00	21.10
18	K2C3	N/A	N/A	N/A	--	18.90	23.30	24.40	20.90
24	P1T1	N/A	N/A	N/A	--	43.10	45.10	43.70	43.20
25	P1T2	N/A	N/A	N/A	--	42.90	42.20	43.20	40.90
26	P1T3	N/A	N/A	N/A	--	33.70	33.90	32.00	30.00
28	P1C1	N/A	N/A	N/A	--	26.60	30.00	26.60	27.80
29	P1C2	N/A	N/A	N/A	--	25.80	34.50	26.10	24.40
30	P1C3	N/A	N/A	N/A	--	30.50	35.20	31.10	29.80

Particle Size Distribution (Water Dispersed) % Silt SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre-plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	N/A	N/A	N/A	--	46.30	46.80	44.70	47.90
2	EIT2	N/A	N/A	N/A	--	49.30	44.60	46.00	47.10
3	E1T3	N/A	N/A	N/A	--	46.60	4.460E+01	46.60	51.00
4	E1C1	N/A	N/A	N/A	--	47.00	43.70	42.00	43.00
5	E1C2	N/A	N/A	N/A	--	48.50	41.10	41.90	--
6	E1C3	N/A	N/A	N/A	--	47.50	46.40	47.50	47.20
7	K1T1	N/A	N/A	N/A	--	--	58.10	57.20	63.50
8	K1T2	N/A	N/A	N/A	--	--	62.20	61.90	66.90
9	KIT3	N/A	N/A	N/A	--	--	68.90	71.60	73.20
16	K2C1	N/A	N/A	N/A	--	61.80	63.50	65.40	69.70
17	K2C2	N/A	N/A	N/A	--	72.60	67.90	68.30	72.80
18	K2C3	N/A	N/A	N/A	--	75.70	68.30	67.80	74.20
24	P1T1	N/A	N/A	N/A	--	48.70	44.90	46.50	46.70
25	P1T2	N/A	N/A	N/A	--	49.20	49.40	48.10	50.90
26	P1T3	N/A	N/A	N/A	--	60.50	59.80	61.50	63.20
28	P1C1	N/A	N/A	N/A	--	66.20	62.20	66.00	66.00
29	P1C2	N/A	N/A	N/A	--	68.30	56.20	68.10	71.10
30	P1C3	N/A	N/A	N/A	--	63.20	57.20	62.70	65.30

Particle Size Distribution (Water Dispersed) % Clay SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	N/A	N/A	N/A	--	22.90	22.40	23.60	22.30
2	EIT2	N/A	N/A	N/A	--	21.80	25.80	23.20	23.50
3	E1T3	N/A	N/A	N/A	--	23.70	2.580E+01	28.50	24.50
4	E1C1	N/A	N/A	N/A	--	23.70	24.50	25.10	21.50
5	E1C2	N/A	N/A	N/A	--	25.10	23.90	23.10	--
6	E1C3	N/A	N/A	N/A	--	27.60	22.60	22.40	20.00
7	K1T1	N/A	N/A	N/A	--	--	23.20	22.50	16.40
8	K1T2	N/A	N/A	N/A	--	--	21.40	20.60	13.50
9	KIT3	N/A	N/A	N/A	--	--	7.70	7.40	5.70
16	K2C1	N/A	N/A	N/A	--	22.10	20.20	15.60	12.20
17	K2C2	N/A	N/A	N/A	--	6.80	8.10	7.70	6.10
18	K2C3	N/A	N/A	N/A	--	5.40	8.30	7.80	5.00
24	P1T1	N/A	N/A	N/A	--	8.20	10.00	9.80	10.10
25	P1T2	N/A	N/A	N/A	--	7.90	8.40	8.60	8.20
26	P1T3	N/A	N/A	N/A	--	5.80	6.40	6.60	6.90
28	P1C1	N/A	N/A	N/A	--	7.10	7.80	7.40	6.20
29	P1C2	N/A	N/A	N/A	--	5.90	9.30	5.80	4.40
30	P1C3	N/A	N/A	N/A	--	6.30	7.50	6.10	4.90

Biomass Activity (mg/kg)
SWEEP Benchmark – Seasonal 1989, 1990 and 1990 Data

SITE CODE	SITE NAME	1990 Post Plant	1990 Post Harvest	1991 Pre–plant	1991 Post Plant	1991 Post Harvest
1	EITI	--	413.70	538.00	958.00	118.90
2	EIT2	--	455.30	550.00	930.00	161.70
3	E1T3	--	577.70	525.00	904.00	181.20
4	E1C1	--	428.40	446.00	726.00	90.30
5	E1C2	--	622.80	444.00	703.00	--
6	E1C3	--	494.80	490.00	710.00	87.60
7	K1T1	--	497.00	362.00	653.00	79.20
8	K1T2	--	578.20	494.00	848.00	100.80
9	KIT3	--	462.80	599.00	881.00	106.70
16	K2C1	--	323.10	587.00	719.00	120.20
17	K2C2	--	566.90	706.00	959.00	124.90
18	K2C3	--	603.30	457.00	967.00	121.30
24	P1T1	--	556.40	498.00	759.00	90.10
25	P1T2	--	448.70	545.00	661.00	77.40
26	P1T3	--	355.50	494.00	706.00	70.50
28	P1C1	--	265.90	445.00	489.00	88.30
29	P1C2	--	99.30	401.00	445.00	89.20
30	P1C3	--	389.60	560.00	555.00	89.90

Plasticity Index (0–15 cm) SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	8.10	10.10	9.60	N/A	N/A	N/A	N/A	N/A
2	EIT2	12.60	9.70	10.60	N/A	N/A	N/A	N/A	N/A
3	E1T3	11.50	10.90	13.10	N/A	N/A	N/A	N/A	N/A
4	E1C1	10.90	11.70	13.50	N/A	N/A	N/A	N/A	N/A
5	E1C2	8.20	10.90	--	N/A	N/A	N/A	N/A	N/A
6	E1C3	11.80	17.10	11.40	N/A	N/A	N/A	N/A	N/A
7	K1T1	11.80	--	9.10	N/A	N/A	N/A	N/A	N/A
8	K1T2	10.20	--	13.30	N/A	N/A	N/A	N/A	N/A
9	KIT3	5.30	--	4.30	N/A	N/A	N/A	N/A	N/A
10	K1C1	6.90	8.50	8.50	N/A	N/A	N/A	N/A	N/A
11	K1C2	6.50	7.20	6.00	N/A	N/A	N/A	N/A	N/A
12	K1C3	7.60	13.30	8.00	N/A	N/A	N/A	N/A	N/A
13	K2T1	13.40	14.90	9.90	N/A	N/A	N/A	N/A	N/A
14	K2T2	NON	1.30	1.70	N/A	N/A	N/A	N/A	N/A
15	K2T3	NON	5.50	0.50	N/A	N/A	N/A	N/A	N/A
16	K2C1	12.00	14.90	6.00	N/A	N/A	N/A	N/A	N/A
17	K2C2	7.40	7.10	7.50	N/A	N/A	N/A	N/A	N/A
18	K2C3	NON–COHI	11.20	4.60	N/A	N/A	N/A	N/A	N/A
19	K3T1	12.40	--	12.90	N/A	N/A	N/A	N/A	N/A
20	K3T2	7.30	--	5.50	N/A	N/A	N/A	N/A	N/A
21	K3T1A	8.80	--	13.80	N/A	N/A	N/A	N/A	N/A
22	K3C1	12.40	--	7.80	N/A	N/A	N/A	N/A	N/A
23	K3C2	9.80	--	7.90	N/A	N/A	N/A	N/A	N/A
24	P1T1	5.10	4.70	2.80	N/A	N/A	N/A	N/A	N/A
25	P1T2	3.20	4.80	2.40	N/A	N/A	N/A	N/A	N/A
26	P1T3	4.90	6.60	2.50	N/A	N/A	N/A	N/A	N/A
27	P1T3A	4.40	4.90	2.30	N/A	N/A	N/A	N/A	N/A
28	P1C1	NON–COHI	3.60	3.20	N/A	N/A	N/A	N/A	N/A
29	P1C2	3.30	4.90	2.60	N/A	N/A	N/A	N/A	N/A
30	P1C3	6.30	3.30	4.90	N/A	N/A	N/A	N/A	N/A
31	P2T1	5.40	5.80	5.00	N/A	N/A	N/A	N/A	N/A
32	P2T2	6.50	8.00	9.20	N/A	N/A	N/A	N/A	N/A
33	P2C1	4.20	--	1.00	N/A	N/A	N/A	N/A	N/A
34	P2C2	--	--	1.20	N/A	N/A	N/A	N/A	N/A
35	P3T1	7.70	9.10	4.50	N/A	N/A	N/A	N/A	N/A
36	P3T2	6.60	8.30	1.00	N/A	N/A	N/A	N/A	N/A
37	P3C1	NON–COHI	--	N/A	N/A	N/A	N/A	N/A	N/A
38	P3C2	NON–COHI	--	N/A	N/A	N/A	N/A	N/A	N/A

Plasticity Index (15–30 cm) SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	10.70	21.90	23.00	N/A	N/A	N/A	N/A	N/A
2	EIT2	12.50	25.20	21.70	N/A	N/A	N/A	N/A	N/A
3	E1T3	13.90	25.90	18.80	N/A	N/A	N/A	N/A	N/A
4	E1C1	11.50	20.70	16.50	N/A	N/A	N/A	N/A	N/A
5	E1C2	9.40	18.90	––	N/A	N/A	N/A	N/A	N/A
6	E1C3	12.60	17.00	14.20	N/A	N/A	N/A	N/A	N/A
7	K1T1	9.90	––	16.90	N/A	N/A	N/A	N/A	N/A
8	K1T2	9.30	––	17.00	N/A	N/A	N/A	N/A	N/A
9	KIT3	3.20	––	7.70	N/A	N/A	N/A	N/A	N/A
10	K1C1	6.80	22.10	10.70	N/A	N/A	N/A	N/A	N/A
11	K1C2	5.20	6.60	9.70	N/A	N/A	N/A	N/A	N/A
12	K1C3	5.80	7.90	10.70	N/A	N/A	N/A	N/A	N/A
13	K2T1	9.20	15.00	15.10	N/A	N/A	N/A	N/A	N/A
14	K2T2	COHESIVE	2.00	2.90	N/A	N/A	N/A	N/A	N/A
15	K2T3	COHESIVE	3.40	0.50	N/A	N/A	N/A	N/A	N/A
16	K2C1	10.10	13.70	11.40	N/A	N/A	N/A	N/A	N/A
17	K2C2	5.80	6.40	9.90	N/A	N/A	N/A	N/A	N/A
18	K2C3	NON–COHI	4.80	4.90	N/A	N/A	N/A	N/A	N/A
19	K3T1	9.30	––	13.00	N/A	N/A	N/A	N/A	N/A
20	K3T2	5.10	––	7.00	N/A	N/A	N/A	N/A	N/A
21	K3T1A	9.40	––	12.60	N/A	N/A	N/A	N/A	N/A
22	K3C1	11.60	––	17.20	N/A	N/A	N/A	N/A	N/A
23	K3C2	7.30	––	8.90	N/A	N/A	N/A	N/A	N/A
24	P1T1	4.20	2.10	1.50	N/A	N/A	N/A	N/A	N/A
25	P1T2	3.20	4.30	3.00	N/A	N/A	N/A	N/A	N/A
26	P1T3	3.70	2.80	2.40	N/A	N/A	N/A	N/A	N/A
27	P1T3A	3.50	8.10	1.40	N/A	N/A	N/A	N/A	N/A
28	P1C1	2.70	8.80	7.10	N/A	N/A	N/A	N/A	N/A
29	P1C2	3.50	4.40	1.50	N/A	N/A	N/A	N/A	N/A
30	P1C3	3.70	6.90	1.60	N/A	N/A	N/A	N/A	N/A
31	P2T1	3.90	8.30	4.60	N/A	N/A	N/A	N/A	N/A
32	P2T2	7.90	5.80	5.70	N/A	N/A	N/A	N/A	N/A
33	P2C1	3.00	––	1.40	N/A	N/A	N/A	N/A	N/A
34	P2C2	3.10	––	2.40	N/A	N/A	N/A	N/A	N/A
35	P3T1	NON–COHI	6.40	8.40	N/A	N/A	N/A	N/A	N/A
36	P3T2	5.40	8.30	3.70	N/A	N/A	N/A	N/A	N/A
37	P3C1	NON–COHI	––	4.20	N/A	N/A	N/A	N/A	N/A
38	P3C2	3.00	––	2.00	N/A	N/A	N/A	N/A	N/A

Organic Matter Content
SWEEP Benchmark – Annual Sampling (post harvest)

SITE CODE	SITE NAME	Organic Matter (%) 1989	Organic Matter (%) 1990	Organic Matter (%) 1991
1	EITI	4.20	3.40	5.10
2	EIT2	4.20	3.40	5.20
3	E1T3	4.10	3.90	5.00
4	E1C1	3.60	4.30	3.40
5	E1C2	3.10	4.80	--
6	E1C3	3.70	4.50	3.20
7	K1T1	1.80	--	2.00
8	K1T2	2.70	--	3.00
9	KIT3	3.20	--	3.10
10	K1C1	3.00	2.90	2.80
11	K1C2	2.50	3.70	2.60
12	K1C3	3.80	0.60	4.00
13	K2T1	1.00	1.10	1.30
14	K2T2	2.20	2.40	2.80
15	K2T3	2.80	3.10	3.20
16	K2C1	2.60	2.60	3.30
17	K2C2	3.80	3.40	3.60
18	K2C3	3.90	4.70	3.90
19	K3T1	2.10	--	2.40
20	K3T2	3.40	--	4.10
21	K3T1A	1.20	--	1.30
22	K3C1	2.10	--	2.40
23	K3C2	3.20	--	2.80
24	P1T1	2.40	3.20	2.40
25	P1T2	2.60	2.70	2.70
26	P1T3	3.60	4.00	3.50
27	P1T3A	3.40	2.90	3.80
28	P1C1	3.00	3.10	2.80
29	P1C2	2.90	3.10	2.90
30	P1C3	4.00	4.10	4.00
31	P2T1	3.20	3.00	3.00
32	P2T2	4.20	4.50	4.60
33	P2C1	3.00	--	2.20
34	P2C2	2.80	--	3.30
35	P3T1	4.70	5.40	5.10
36	P3T2	4.00	4.30	4.60
37	P3C1	2.10	--	2.80
38	P3C2	2.50	--	3.20

Fertility Levels – Phopshorus (mg/l) SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre-plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	17.00	11.00	22.00	N/A	N/A	N/A	N/A	N/A
2	EIT2	12.00	7.00	19.00	N/A	N/A	N/A	N/A	N/A
3	E1T3	14.00	38.00	18.00	N/A	N/A	N/A	N/A	N/A
4	E1C1	17.00	12.00	12.00	N/A	N/A	N/A	N/A	N/A
5	E1C2	10.00	22.00	--	N/A	N/A	N/A	N/A	N/A
6	E1C3	12.00	12.00	10.00	N/A	N/A	N/A	N/A	N/A
7	K1T1	17.00	--	20.00	N/A	N/A	N/A	N/A	N/A
8	K1T2	20.00	--	19.00	N/A	N/A	N/A	N/A	N/A
9	KIT3	18.00	--	14.00	N/A	N/A	N/A	N/A	N/A
10	K1C1	27.00	19.00	25.00	N/A	N/A	N/A	N/A	N/A
11	K1C2	25.00	18.00	30.00	N/A	N/A	N/A	N/A	N/A
12	K1C3	22.00	5.00	19.00	N/A	N/A	N/A	N/A	N/A
13	K2T1	9.00	9.00	8.00	N/A	N/A	N/A	N/A	N/A
14	K2T2	12.00	13.00	8.00	N/A	N/A	N/A	N/A	N/A
15	K2T3	17.00	14.00	8.00	N/A	N/A	N/A	N/A	N/A
16	K2C1	17.00	15.00	14.00	N/A	N/A	N/A	N/A	N/A
17	K2C2	22.00	31.00	13.00	N/A	N/A	N/A	N/A	N/A
18	K2C3	26.00	40.00	30.00	N/A	N/A	N/A	N/A	N/A
19	K3T1	22.00	--	41.00	N/A	N/A	N/A	N/A	N/A
20	K3T2	20.00	--	19.00	N/A	N/A	N/A	N/A	N/A
21	K3T1A	15.00	--	19.00	N/A	N/A	N/A	N/A	N/A
22	K3C1	15.00	--	18.00	N/A	N/A	N/A	N/A	N/A
23	K3C2	39.00	--	21.00	N/A	N/A	N/A	N/A	N/A
24	P1T1	37.00	26.00	44.00	N/A	N/A	N/A	N/A	N/A
25	P1T2	32.00	28.00	53.00	N/A	N/A	N/A	N/A	N/A
26	P1T3	32.00	27.00	45.00	N/A	N/A	N/A	N/A	N/A
27	P1T3A	36.00	26.00	50.00	N/A	N/A	N/A	N/A	N/A
28	P1C1	25.00	38.00	24.00	N/A	N/A	N/A	N/A	N/A
29	P1C2	12.00	15.00	11.00	N/A	N/A	N/A	N/A	N/A
30	P1C3	10.00	18.00	13.00	N/A	N/A	N/A	N/A	N/A
31	P2T1	18.00	17.00	17.00	N/A	N/A	N/A	N/A	N/A
32	P2T2	19.00	35.00	16.00	N/A	N/A	N/A	N/A	N/A
33	P2C1	19.00	--	11.00	N/A	N/A	N/A	N/A	N/A
34	P2C2	18.00	--	25.00	N/A	N/A	N/A	N/A	N/A
35	P3T1	34.00	40.00	36.00	N/A	N/A	N/A	N/A	N/A
36	P3T2	25.00	28.00	34.00	N/A	N/A	N/A	N/A	N/A
37	P3C1	230.00	--	18.00	N/A	N/A	N/A	N/A	N/A
38	P3C2	12.00	--	9.00	N/A	N/A	N/A	N/A	N/A

Fertility Levels – Potassium (mg/l) SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	395.00	452.00	169.50	N/A	N/A	N/A	N/A	N/A
2	EIT2	715.00	442.00	162.80	N/A	N/A	N/A	N/A	N/A
3	E1T3	250.00	452.00	215.40	N/A	N/A	N/A	N/A	N/A
4	E1C1	192.00	230.00	151.70	N/A	N/A	N/A	N/A	N/A
5	E1C2	165.00	330.00	--	N/A	N/A	N/A	N/A	N/A
6	E1C3	160.00	270.00	112.30	N/A	N/A	N/A	N/A	N/A
7	K1T1	395.00	--	92.00	N/A	N/A	N/A	N/A	N/A
8	K1T2	371.00	--	109.80	N/A	N/A	N/A	N/A	N/A
9	KIT3	285.00	--	118.20	N/A	N/A	N/A	N/A	N/A
10	K1C1	256.00	124.00	132.00	N/A	N/A	N/A	N/A	N/A
11	K1C2	145.00	124.00	127.00	N/A	N/A	N/A	N/A	N/A
12	K1C3	213.00	90.80	172.40	N/A	N/A	N/A	N/A	N/A
13	K2T1	178.00	168.00	88.00	N/A	N/A	N/A	N/A	N/A
14	K2T2	274.00	76.00	77.40	N/A	N/A	N/A	N/A	N/A
15	K2T3	276.00	168.00	140.10	N/A	N/A	N/A	N/A	N/A
16	K2C1	126.00	142.00	76.20	N/A	N/A	N/A	N/A	N/A
17	K2C2	95.00	102.00	57.40	N/A	N/A	N/A	N/A	N/A
18	K2C3	86.00	285.00	101.40	N/A	N/A	N/A	N/A	N/A
19	K3T1	152.00	--	102.00	N/A	N/A	N/A	N/A	N/A
20	K3T2	171.00	--	108.20	N/A	N/A	N/A	N/A	N/A
21	K3T1A	197.00	--	152.30	N/A	N/A	N/A	N/A	N/A
22	K3C1	129.00	--	108.20	N/A	N/A	N/A	N/A	N/A
23	K3C2	254.00	--	121.60	N/A	N/A	N/A	N/A	N/A
24	P1T1	248.00	138.00	107.80	N/A	N/A	N/A	N/A	N/A
25	P1T2	182.00	181.00	170.20	N/A	N/A	N/A	N/A	N/A
26	P1T3	304.00	338.00	159.30	N/A	N/A	N/A	N/A	N/A
27	P1T3A	284.00	179.00	143.60	N/A	N/A	N/A	N/A	N/A
28	P1C1	265.00	252.00	95.10	N/A	N/A	N/A	N/A	N/A
29	P1C2	238.00	167.00	120.20	N/A	N/A	N/A	N/A	N/A
30	P1C3	210.00	211.00	139.90	N/A	N/A	N/A	N/A	N/A
31	P2T1	197.00	180.00	74.50	N/A	N/A	N/A	N/A	N/A
32	P2T2	179.00	169.00	47.40	N/A	N/A	N/A	N/A	N/A
33	P2C1	295.00	--	98.00	N/A	N/A	N/A	N/A	N/A
34	P2C2	382.00	--	79.10	N/A	N/A	N/A	N/A	N/A
35	P3T1	136.00	179.00	125.60	N/A	N/A	N/A	N/A	N/A
36	P3T2	145.00	114.00	102.40	N/A	N/A	N/A	N/A	N/A
37	P3C1	490.00	--	231.00	N/A	N/A	N/A	N/A	N/A
38	P3C2	377.00	--	81.40	N/A	N/A	N/A	N/A	N/A

Fertility Levels – Magnesium (mg/l) SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	421.00	386.00	193.00	N/A	N/A	N/A	N/A	N/A
2	EIT2	390.00	600.00	271.00	N/A	N/A	N/A	N/A	N/A
3	E1T3	400.00	560.00	300.00	N/A	N/A	N/A	N/A	N/A
4	E1C1	389.00	560.00	300.00	N/A	N/A	N/A	N/A	N/A
5	E1C2	356.00	509.00	––	N/A	N/A	N/A	N/A	N/A
6	E1C3	400.00	510.00	239.00	N/A	N/A	N/A	N/A	N/A
7	K1T1	421.00	––	77.00	N/A	N/A	N/A	N/A	N/A
8	K1T2	304.00	––	94.00	N/A	N/A	N/A	N/A	N/A
9	KIT3	135.00	––	138.00	N/A	N/A	N/A	N/A	N/A
10	K1C1	3464.00	283.00	178.00	N/A	N/A	N/A	N/A	N/A
11	K1C2	368.00	297.00	90.00	N/A	N/A	N/A	N/A	N/A
12	K1C3	395.00	362.00	186.00	N/A	N/A	N/A	N/A	N/A
13	K2T1	207.00	85.00	64.00	N/A	N/A	N/A	N/A	N/A
14	K2T2	233.00	42.00	58.00	N/A	N/A	N/A	N/A	N/A
15	K2T3	230.00	140.00	84.00	N/A	N/A	N/A	N/A	N/A
16	K2C1	390.00	181.00	124.00	N/A	N/A	N/A	N/A	N/A
17	K2C2	386.00	164.00	128.00	N/A	N/A	N/A	N/A	N/A
18	K2C3	320.00	380.00	133.00	N/A	N/A	N/A	N/A	N/A
19	K3T1	317.00	––	106.00	N/A	N/A	N/A	N/A	N/A
20	K3T2	360.00	––	159.00	N/A	N/A	N/A	N/A	N/A
21	K3T1A	225.00	––	99.00	N/A	N/A	N/A	N/A	N/A
22	K3C1	390.00	––	175.00	N/A	N/A	N/A	N/A	N/A
23	K3C2	287.00	––	165.00	N/A	N/A	N/A	N/A	N/A
24	P1T1	385.00	311.00	186.00	N/A	N/A	N/A	N/A	N/A
25	P1T2	375.00	265.00	181.00	N/A	N/A	N/A	N/A	N/A
26	P1T3	326.00	174.00	147.00	N/A	N/A	N/A	N/A	N/A
27	P1T3A	320.00	96.00	132.00	N/A	N/A	N/A	N/A	N/A
28	P1C1	352.00	277.00	96.00	N/A	N/A	N/A	N/A	N/A
29	P1C2	356.00	352.00	125.00	N/A	N/A	N/A	N/A	N/A
30	P1C3	371.00	365.00	142.00	N/A	N/A	N/A	N/A	N/A
31	P2T1	323.00	270.00	118.00	N/A	N/A	N/A	N/A	N/A
32	P2T2	351.00	220.00	155.00	N/A	N/A	N/A	N/A	N/A
33	P2C1	342.00	––	125.00	N/A	N/A	N/A	N/A	N/A
34	P2C2	460.00	––	140.00	N/A	N/A	N/A	N/A	N/A
35	P3T1	375.00	368.00	189.00	N/A	N/A	N/A	N/A	N/A
36	P3T2	347.00	435.00	177.00	N/A	N/A	N/A	N/A	N/A
37	P3C1	250.00	––	91.00	N/A	N/A	N/A	N/A	N/A
38	P3C2	330.00	––	101.00	N/A	N/A	N/A	N/A	N/A

Fertility Levels – Calcium (mg/l) SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	2830.00	1688.00	N/A	N/A	N/A	N/A	N/A	N/A
2	EIT2	2910.00	1750.00	N/A	N/A	N/A	N/A	N/A	N/A
3	E1T3	3340.00	2900.00	N/A	N/A	N/A	N/A	N/A	N/A
4	E1C1	3260.00	2382.00	N/A	N/A	N/A	N/A	N/A	N/A
5	E1C2	3470.00	2492.00	N/A	N/A	N/A	N/A	N/A	N/A
6	E1C3	3480.00	2137.00	N/A	N/A	N/A	N/A	N/A	N/A
7	K1T1	2830.00	--	N/A	N/A	N/A	N/A	N/A	N/A
8	K1T2	3460.00	--	N/A	N/A	N/A	N/A	N/A	N/A
9	KIT3	3060.00	--	N/A	N/A	N/A	N/A	N/A	N/A
10	K1C1	2940.00	2304.00	N/A	N/A	N/A	N/A	N/A	N/A
11	K1C2	3130.00	2451.00	N/A	N/A	N/A	N/A	N/A	N/A
12	K1C3	3260.00	5137.00	N/A	N/A	N/A	N/A	N/A	N/A
13	K2T1	3120.00	4988.00	N/A	N/A	N/A	N/A	N/A	N/A
14	K2T2	3260.00	1264.00	N/A	N/A	N/A	N/A	N/A	N/A
15	K2T3	3120.00	1296.00	N/A	N/A	N/A	N/A	N/A	N/A
16	K2C1	3460.00	4439.00	N/A	N/A	N/A	N/A	N/A	N/A
17	K2C2	4270.00	1791.00	N/A	N/A	N/A	N/A	N/A	N/A
18	K2C3	2260.00	2450.00	N/A	N/A	N/A	N/A	N/A	N/A
19	K3T1	5310.00	--	N/A	N/A	N/A	N/A	N/A	N/A
20	K3T2	3120.00	--	N/A	N/A	N/A	N/A	N/A	N/A
21	K3T1A	6240.00	--	N/A	N/A	N/A	N/A	N/A	N/A
22	K3C1	3460.00	--	N/A	N/A	N/A	N/A	N/A	N/A
23	K3C2	2760.00	--	N/A	N/A	N/A	N/A	N/A	N/A
24	P1T1	2610.00	1492.00	N/A	N/A	N/A	N/A	N/A	N/A
25	P1T2	2320.00	1462.00	N/A	N/A	N/A	N/A	N/A	N/A
26	P1T3	2460.00	1421.00	N/A	N/A	N/A	N/A	N/A	N/A
27	P1T3A	2370.00	987.00	N/A	N/A	N/A	N/A	N/A	N/A
28	P1C1	2765.00	3180.00	N/A	N/A	N/A	N/A	N/A	N/A
29	P1C2	2640.00	2326.00	N/A	N/A	N/A	N/A	N/A	N/A
30	P1C3	2870.00	2335.00	N/A	N/A	N/A	N/A	N/A	N/A
31	P2T1	2680.00	1390.00	N/A	N/A	N/A	N/A	N/A	N/A
32	P2T2	2710.00	2137.00	N/A	N/A	N/A	N/A	N/A	N/A
33	P2C1	2690.00	--	N/A	N/A	N/A	N/A	N/A	N/A
34	P2C2	2770.00	--	N/A	N/A	N/A	N/A	N/A	N/A
35	P3T1	3160.00	2507.00	N/A	N/A	N/A	N/A	N/A	N/A
36	P3T2	3710.00	3273.00	N/A	N/A	N/A	N/A	N/A	N/A
37	P3C1	3120.00	--	N/A	N/A	N/A	N/A	N/A	N/A
38	P3C2	3240.00	--	N/A	N/A	N/A	N/A	N/A	N/A

Corrected Wet Aggregrate Stability (W.A.S.) Using Field Moisture Content
SWEEP Benchmark – Annual 1989, 1990 and 1991 Data

SITE	SITE	1989 W.A.S. (%)	1990 Corrected W.A.S. (%)	1991 Corrected W.A.S. (%)	1990 W.A.S. (%)	1991 W.A.S. (%)
1	EITI	16.30	18.01	42.76	17.80	43.04
2	EIT2	17.83		39.94	13.20	41.42
3	E1T3	16.83	15.43	42.78	15.20	43.51
4	E1C1	17.79		28.83	19.10	24.93
5	E1C2	22.71	18.67	--	18.50	
6	E1C3	16.30	19.98	34.50	19.80	32.39
7	K1T1	13.44	14.36	25.61	14.30	27.54
8	K1T2	11.20	9.34	34.73	9.40	34.12
9	KIT3	29.01	6.42	28.09	6.50	22.85
10	K1C1	12.38	16.17	27.20	16.20	36.15
11	K1C2	11.85	15.38	25.16	15.50	35.30
12	K1C3	26.42	5.62	44.86	5.60	50.97
13	K2T1	11.94	10.38	26.83	10.20	28.31
14	K2T2	30.86	11.46	42.08	11.30	45.50
15	K2T3	52.64	13.44	42.36	13.40	45.33
16	K2C1	18.29	25.11	41.68	25.10	39.27
17	K2C2	47.39	21.91	49.79	22.00	46.19
18	K2C3	46.40	26.31	42.00	26.50	38.55
19	K3T1	21.17	13.18	33.62	13.20	35.40
20	K3T2	23.79	13.29	40.80	13.50	37.35
21	K3T1A	9.23	13.89	25.73	13.80	26.01
22	K3C1	20.75	20.16	33.93	20.20	42.58
23	K3C2	13.20	14.22	32.64	14.30	39.05
24	P1T1	25.21	10.44	20.85	10.20	20.84
25	P1T2	23.58	10.66	22.73	10.50	15.69
26	P1T3	50.58	18.61	26.08	18.40	15.76
27	P1T3A	52.69	14.15	25.64	14.00	15.77
28	P1C1	35.16	14.98	27.45	15.10	32.66
29	P1C2	20.24	9.39	28.76	9.50	32.03
30	P1C3	31.90	13.78	43.46	13.90	46.28
31	P2T1	41.90	8.69	34.92	8.80	38.04
32	P2T2	43.98	14.31	35.58	14.50	28.54
33	P2C1	41.22		18.56	--	14.36
34	P2C2	46.40		32.83	--	22.21
35	P3T1	17.44	23.66	53.15	23.80	50.74
36	P3T2	20.37	22.50	44.64	22.60	43.88
37	P3C1	20.80	7.84	17.65	8.00	22.27
38	P3C2	20.80	6.24	25.94	6.40	29.51

pH Values SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre-plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	6.90	4.70	6.20	N/A	N/A	N/A	N/A	N/A
2	EIT2	7.40	5.60	6.10	N/A	N/A	N/A	N/A	N/A
3	E1T3	6.10	6.90	6.20	N/A	N/A	N/A	N/A	N/A
4	E1C1	6.60	6.00	6.40	N/A	N/A	N/A	N/A	N/A
5	E1C2	6.80	6.20	--	N/A	N/A	N/A	N/A	N/A
6	E1C3	7.20	6.30	5.70	N/A	N/A	N/A	N/A	N/A
7	K1T1	7.50	--	7.60	N/A	N/A	N/A	N/A	N/A
8	K1T2	7.70	--	7.60	N/A	N/A	N/A	N/A	N/A
9	KIT3	6.20	--	6.50	N/A	N/A	N/A	N/A	N/A
10	K1C1	7.00	7.50	7.70	N/A	N/A	N/A	N/A	N/A
11	K1C2	7.10	7.30	7.80	N/A	N/A	N/A	N/A	N/A
12	K1C3	6.30	7.60	7.30	N/A	N/A	N/A	N/A	N/A
13	K2T1	7.60	7.60	7.70	N/A	N/A	N/A	N/A	N/A
14	K2T2	6.60	7.10	6.80	N/A	N/A	N/A	N/A	N/A
15	K2T3	6.30	6.50	6.00	N/A	N/A	N/A	N/A	N/A
16	K2C1	6.50	7.60	6.30	N/A	N/A	N/A	N/A	N/A
17	K2C2	6.00	6.10	6.30	N/A	N/A	N/A	N/A	N/A
18	K2C3	6.00	6.50	6.70	N/A	N/A	N/A	N/A	N/A
19	K3T1	7.30	--	7.10	N/A	N/A	N/A	N/A	N/A
20	K3T2	6.10	--	6.30	N/A	N/A	N/A	N/A	N/A
21	K3T1A	7.60	--	7.70	N/A	N/A	N/A	N/A	N/A
22	K3C1	7.10	--	7.60	N/A	N/A	N/A	N/A	N/A
23	K3C2	7.00	--	7.40	N/A	N/A	N/A	N/A	N/A
24	P1T1	6.90	6.80	7.10	N/A	N/A	N/A	N/A	N/A
25	P1T2	6.00	6.30	6.70	N/A	N/A	N/A	N/A	N/A
26	P1T3	5.00	5.20	5.90	N/A	N/A	N/A	N/A	N/A
27	P1T3A	5.20	5.20	5.90	N/A	N/A	N/A	N/A	N/A
28	P1C1	7.10	7.30	7.60	N/A	N/A	N/A	N/A	N/A
29	P1C2	6.50	6.70	7.00	N/A	N/A	N/A	N/A	N/A
30	P1C3	6.60	6.70	6.90	N/A	N/A	N/A	N/A	N/A
31	P2T1	6.30	6.70	6.60	N/A	N/A	N/A	N/A	N/A
32	P2T2	6.20	6.60	6.30	N/A	N/A	N/A	N/A	N/A
33	P2C1	5.90	--	6.30	N/A	N/A	N/A	N/A	N/A
34	P2C2	5.70	--	7.30	N/A	N/A	N/A	N/A	N/A
35	P3T1	6.40	6.90	6.70	N/A	N/A	N/A	N/A	N/A
36	P3T2	7.00	7.10	7.40	N/A	N/A	N/A	N/A	N/A
37	P3C1	5.20	--	6.30	N/A	N/A	N/A	N/A	N/A
38	P3C2	5.50	--	6.40	N/A	N/A	N/A	N/A	N/A

Cation Exchange Capacity (C.E.C.)
Sweep Benchmark Annual Sampling (post harvest)

SITE CODE	SITE NAME	C.E.C. (meq/100g) 1989	C.E.C. (meq/100g) 1990	C.E.C. (meq/100g) 1991
1	EITI	21.0	23.4	23.1
2	EIT2	16.6	21.4	24.1
3	E1T3	22.0	28.2	25.8
4	E1C1	21.4	22.4	18.6
5	E1C2	28.8	25.9	--
6	E1C3	20.4	30.1	13.6
7	K1T1	18.3	--	17.7
8	K1T2	21.4	--	24.1
9	KIT3	11.9	--	10.1
10	K1C1	17.8	22.2	21.6
11	K1C2	14.6	27.1	21.6
12	K1C3	16.2	35.1	21.8
13	K2T1	25.5	26.3	12.8
14	K2T2	6.5	12.5	7.0
15	K2T3	9.1	15.4	8.9
16	K2C1	16.8	27.0	19.6
17	K2C2	15.3	17.8	19.8
18	K2C3	12.7	26.8	19.0
19	K3T1	22.1	--	16.0
20	K3T2	15.8	--	18.0
21	K3T1A	24.5	--	27.8
22	K3C1	18.3	--	23.5
23	K3C2	18.2	--	24.8
24	P1T1	12.2	17.8	15.4
25	P1T2	11.6	14.7	13.2
26	P1T3	10.0	13.7	12.1
27	P1T3A	12.2	13.8	14.8
28	P1C1	15.7	19.7	25.9
29	P1C2	12.2	15.5	10.5
30	P1C3	14.6	21.4	19.6
31	P2T1	11.6	17.8	11.9
32	P2T2	16.7	22.4	20.6
33	P2C1	7.7	--	7.0
34	P2C2	6.6	--	12.5
35	P3T1	26.3	31.1	27.5
36	P3T2	11.2	42.2	27.1
37	P3C1	2.4	--	7.7
38	P3C2	9.7	--	9.3

Calcium Carbonate Levels (CaCO3) (%) SWEEP Benchmarks – Annual and Seasonal Data

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	0.00	0.20	0.90	N/A	N/A	N/A	N/A	N/A
2	EIT2	0.50	0.50	0.80	N/A	N/A	N/A	N/A	N/A
3	E1T3	0.00	0.50	0.50	N/A	N/A	N/A	N/A	N/A
4	E1C1	0.00	0.40	0.60	N/A	N/A	N/A	N/A	N/A
5	E1C2	0.00	0.50	--	N/A	N/A	N/A	N/A	N/A
6	E1C3	0.40	0.20	0.80	N/A	N/A	N/A	N/A	N/A
7	K1T1	1.20	--	1.10	N/A	N/A	N/A	N/A	N/A
8	K1T2	3.60	--	1.90	N/A	N/A	N/A	N/A	N/A
9	KIT3	0.00	--	0.40	N/A	N/A	N/A	N/A	N/A
10	K1C1	0.50	0.40	0.90	N/A	N/A	N/A	N/A	N/A
11	K1C2	0.50	0.50	3.00	N/A	N/A	N/A	N/A	N/A
12	K1C3	0.00	6.60	0.50	N/A	N/A	N/A	N/A	N/A
13	K2T1	7.50	5.90	4.10	N/A	N/A	N/A	N/A	N/A
14	K2T2	0.00	0.20	0.50	N/A	N/A	N/A	N/A	N/A
15	K2T3	0.00	0.20	0.50	N/A	N/A	N/A	N/A	N/A
16	K2C1	0.00	1.10	0.50	N/A	N/A	N/A	N/A	N/A
17	K2C2	0.00	0.70	0.50	N/A	N/A	N/A	N/A	N/A
18	K2C3	0.00	0.60	1.20	N/A	N/A	N/A	N/A	N/A
19	K3T1	0.80	--	0.60	N/A	N/A	N/A	N/A	N/A
20	K3T2	0.00	--	0.20	N/A	N/A	N/A	N/A	N/A
21	K3T1A	10.70	--	14.70	N/A	N/A	N/A	N/A	N/A
22	K3C1	1.10	--	0.60	N/A	N/A	N/A	N/A	N/A
23	K3C2	0.80	--	1.30	N/A	N/A	N/A	N/A	N/A
24	P1T1	0.00	0.50	0.50	N/A	N/A	N/A	N/A	N/A
25	P1T2	0.00	0.20	0.30	N/A	N/A	N/A	N/A	N/A
26	P1T3	0.00	0.20	0.80	N/A	N/A	N/A	N/A	N/A
27	P1T3A	0.00	0.40	0.30	N/A	N/A	N/A	N/A	N/A
28	P1C1	0.60	1.90	0.80	N/A	N/A	N/A	N/A	N/A
29	P1C2	0.00	0.40	0.50	N/A	N/A	N/A	N/A	N/A
30	P1C3	0.00	0.70	0.30	N/A	N/A	N/A	N/A	N/A
31	P2T1	0.00	0.50	0.60	N/A	N/A	N/A	N/A	N/A
32	P2T2	0.00	0.40	0.20	N/A	N/A	N/A	N/A	N/A
33	P2C1	0.00	--	0.20	N/A	N/A	N/A	N/A	N/A
34	P2C2	0.00	--	0.80	N/A	N/A	N/A	N/A	N/A
35	P3T1	0.00	0.50	0.60	N/A	N/A	N/A	N/A	N/A
36	P3T2	0.80	0.60	1.10	N/A	N/A	N/A	N/A	N/A
37	P3C1	0.00	--	0.80	N/A	N/A	N/A	N/A	N/A
38	P3C2	0.00	--	1.20	N/A	N/A	N/A	N/A	N/A

Available Moisture Holding Capacity (% by Mass) 0–15 cm Depth Saturated SWEEP Benchmarks – Annual and

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	33.80	N/A	44.02	N/A	N/A	N/A	N/A	N/A
2	EIT2	36.99	N/A	55.16	N/A	N/A	N/A	N/A	N/A
3	E1T3	34.27	N/A	52.52	N/A	N/A	N/A	N/A	N/A
4	E1C1	30.58	N/A	30.96	N/A	N/A	N/A	N/A	N/A
5	E1C2	28.45	N/A	––	N/A	N/A	N/A	N/A	N/A
6	E1C3	36.19	N/A	34.41	N/A	N/A	N/A	N/A	N/A
7	K1T1	24.58	N/A	31.99	N/A	N/A	N/A	N/A	N/A
8	K1T2	30.29	N/A	32.41	N/A	N/A	N/A	N/A	N/A
9	KIT3	40.14	N/A	34.13	N/A	N/A	N/A	N/A	N/A
10	K1C1	36.22	N/A	35.78	N/A	N/A	N/A	N/A	N/A
11	K1C2	25.59	N/A	29.85	N/A	N/A	N/A	N/A	N/A
12	K1C3	33.33	N/A	41.39	N/A	N/A	N/A	N/A	N/A
13	K2T1	30.29	N/A	27.47	N/A	N/A	N/A	N/A	N/A
14	K2T2	28.34	N/A	30.32	N/A	N/A	N/A	N/A	N/A
15	K2T3	31.13	N/A	29.17	N/A	N/A	N/A	N/A	N/A
16	K2C1	26.44	N/A	39.77	N/A	N/A	N/A	N/A	N/A
17	K2C2	33.94	N/A	49.18	N/A	N/A	N/A	N/A	N/A
18	K2C3	30.60	N/A	48.94	N/A	N/A	N/A	N/A	N/A
19	K3T1	28.23	N/A	34.74	N/A	N/A	N/A	N/A	N/A
20	K3T2	32.74	N/A	36.75	N/A	N/A	N/A	N/A	N/A
21	K3T1A	31.15	N/A	23.86	N/A	N/A	N/A	N/A	N/A
22	K3C1	29.80	N/A	33.23	N/A	N/A	N/A	N/A	N/A
23	K3C2	27.67	N/A	42.78	N/A	N/A	N/A	N/A	N/A
24	P1T1	36.07	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25	P1T2	32.69	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26	P1T3	39.80	N/A	N/A	N/A	N/A	N/A	N/A	N/A
27	P1T3A	49.18	N/A	N/A	N/A	N/A	N/A	N/A	N/A
28	P1C1	40.11	N/A	43.63	N/A	N/A	N/A	N/A	N/A
29	P1C2	39.98	N/A	52.30	N/A	N/A	N/A	N/A	N/A
30	P1C3	37.39	N/A	44.51	N/A	N/A	N/A	N/A	N/A
31	P2T1	36.44	N/A	34.19	N/A	N/A	N/A	N/A	N/A
32	P2T2	41.74	N/A	39.14	N/A	N/A	N/A	N/A	N/A
33	P2C1	33.84	N/A	N/A	N/A	N/A	N/A	N/A	N/A
34	P2C2	36.67	N/A	N/A	N/A	N/A	N/A	N/A	N/A
35	P3T1	41.60	N/A	47.51	N/A	N/A	N/A	N/A	N/A
36	P3T2	29.77	N/A	41.51	N/A	N/A	N/A	N/A	N/A
37	P3C1	28.35	N/A	37.27	N/A	N/A	N/A	N/A	N/A
38	P3C2	31.20	N/A	30.32	N/A	N/A	N/A	N/A	N/A

Available Moisture Holding Capacity (% by Mass) 0–15 cm Depth 100 mB SWEEP Benchmarks – Annual and S

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	27.62	N/A	27.86	N/A	N/A	N/A	N/A	N/A
2	EIT2	28.67	N/A	28.44	N/A	N/A	N/A	N/A	N/A
3	E1T3	28.81	N/A	30.48	N/A	N/A	N/A	N/A	N/A
4	E1C1	26.39	N/A	24.41	N/A	N/A	N/A	N/A	N/A
5	E1C2	24.26	N/A	––	N/A	N/A	N/A	N/A	N/A
6	E1C3	27.88	N/A	23.81	N/A	N/A	N/A	N/A	N/A
7	K1T1	21.40	N/A	23.17	N/A	N/A	N/A	N/A	N/A
8	K1T2	24.38	N/A	24.82	N/A	N/A	N/A	N/A	N/A
9	KIT3	31.44	N/A	26.48	N/A	N/A	N/A	N/A	N/A
10	K1C1	24.68	N/A	25.54	N/A	N/A	N/A	N/A	N/A
11	K1C2	22.27	N/A	22.29	N/A	N/A	N/A	N/A	N/A
12	K1C3	28.52	N/A	29.13	N/A	N/A	N/A	N/A	N/A
13	K2T1	24.38	N/A	22.10	N/A	N/A	N/A	N/A	N/A
14	K2T2	25.12	N/A	21.37	N/A	N/A	N/A	N/A	N/A
15	K2T3	25.41	N/A	22.31	N/A	N/A	N/A	N/A	N/A
16	K2C1	24.70	N/A	25.06	N/A	N/A	N/A	N/A	N/A
17	K2C2	31.42	N/A	30.42	N/A	N/A	N/A	N/A	N/A
18	K2C3	26.91	N/A	30.70	N/A	N/A	N/A	N/A	N/A
19	K3T1	25.26	N/A	23.79	N/A	N/A	N/A	N/A	N/A
20	K3T2	27.15	N/A	27.53	N/A	N/A	N/A	N/A	N/A
21	K3T1A	24.82	N/A	20.89	N/A	N/A	N/A	N/A	N/A
22	K3C1	24.26	N/A	24.39	N/A	N/A	N/A	N/A	N/A
23	K3C2	25.70	N/A	25.64	N/A	N/A	N/A	N/A	N/A
24	P1T1	23.40	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25	P1T2	25.40	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26	P1T3	31.61	N/A	N/A	N/A	N/A	N/A	N/A	N/A
27	P1T3A	33.56	N/A	N/A	N/A	N/A	N/A	N/A	N/A
28	P1C1	28.70	N/A	27.78	N/A	N/A	N/A	N/A	N/A
29	P1C2	38.45	N/A	30.41	N/A	N/A	N/A	N/A	N/A
30	P1C3	30.87	N/A	28.12	N/A	N/A	N/A	N/A	N/A
31	P2T1	29.79	N/A	24.35	N/A	N/A	N/A	N/A	N/A
32	P2T2	29.62	N/A	27.14	N/A	N/A	N/A	N/A	N/A
33	P2C1	25.87	N/A	N/A	N/A	N/A	N/A	N/A	N/A
34	P2C2	28.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A
35	P3T1	27.66	N/A	30.88	N/A	N/A	N/A	N/A	N/A
36	P3T2	25.07	N/A	29.18	N/A	N/A	N/A	N/A	N/A
37	P3C1	23.98	N/A	26.34	N/A	N/A	N/A	N/A	N/A
38	P3C2	24.97	N/A	24.48	N/A	N/A	N/A	N/A	N/A

Available Moisture Holding Capacity (% by Mass) 0–15 cm Depth 15 Bar SWEEP Benchmarks – Annual and Se

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	24.11	N/A	18.07	N/A	N/A	N/A	N/A	N/A
2	EIT2	23.46	N/A	18.55	N/A	N/A	N/A	N/A	N/A
3	E1T3	25.13	N/A	18.51	N/A	N/A	N/A	N/A	N/A
4	E1C1	22.63	N/A	16.79	N/A	N/A	N/A	N/A	N/A
5	E1C2	17.54	N/A	––	N/A	N/A	N/A	N/A	N/A
6	E1C3	22.09	N/A	14.26	N/A	N/A	N/A	N/A	N/A
7	K1T1	18.47	N/A	14.64	N/A	N/A	N/A	N/A	N/A
8	K1T2	20.81	N/A	13.08	N/A	N/A	N/A	N/A	N/A
9	KIT3	27.38	N/A	13.55	N/A	N/A	N/A	N/A	N/A
10	K1C1	18.42	N/A	15.51	N/A	N/A	N/A	N/A	N/A
11	K1C2	19.27	N/A	16.54	N/A	N/A	N/A	N/A	N/A
12	K1C3	23.43	N/A	16.22	N/A	N/A	N/A	N/A	N/A
13	K2T1	20.81	N/A	14.28	N/A	N/A	N/A	N/A	N/A
14	K2T2	9.96	N/A	7.49	N/A	N/A	N/A	N/A	N/A
15	K2T3	21.04	N/A	11.87	N/A	N/A	N/A	N/A	N/A
16	K2C1	21.77	N/A	15.38	N/A	N/A	N/A	N/A	N/A
17	K2C2	27.56	N/A	15.15	N/A	N/A	N/A	N/A	N/A
18	K2C3	24.80	N/A	13.10	N/A	N/A	N/A	N/A	N/A
19	K3T1	22.45	N/A	13.47	N/A	N/A	N/A	N/A	N/A
20	K3T2	22.50	N/A	13.29	N/A	N/A	N/A	N/A	N/A
21	K3T1A	20.79	N/A	15.86	N/A	N/A	N/A	N/A	N/A
22	K3C1	17.22	N/A	16.84	N/A	N/A	N/A	N/A	N/A
23	K3C2	22.50	N/A	13.67	N/A	N/A	N/A	N/A	N/A
24	P1T1	14.68	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25	P1T2	19.88	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26	P1T3	25.24	N/A	N/A	N/A	N/A	N/A	N/A	N/A
27	P1T3A	21.69	N/A	N/A	N/A	N/A	N/A	N/A	N/A
28	P1C1	18.45	N/A	11.40	N/A	N/A	N/A	N/A	N/A
29	P1C2	19.94	N/A	10.27	N/A	N/A	N/A	N/A	N/A
30	P1C3	17.08	N/A	12.12	N/A	N/A	N/A	N/A	N/A
31	P2T1	21.46	N/A	12.56	N/A	N/A	N/A	N/A	N/A
32	P2T2	21.02	N/A	16.94	N/A	N/A	N/A	N/A	N/A
33	P2C1	16.51	N/A	N/A	N/A	N/A	N/A	N/A	N/A
34	P2C2	16.03	N/A	N/A	N/A	N/A	N/A	N/A	N/A
35	P3T1	21.53	N/A	16.29	N/A	N/A	N/A	N/A	N/A
36	P3T2	21.77	N/A	14.64	N/A	N/A	N/A	N/A	N/A
37	P3C1	18.53	N/A	10.66	N/A	N/A	N/A	N/A	N/A
38	P3C2	22.59	N/A	12.70	N/A	N/A	N/A	N/A	N/A

Available Moisture Holding Capacity (% by Mass) 15–30 cm Depth Saturated SWEEP Benchmarks – Annual and

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	29.47	N/A	36.39	N/A	N/A	N/A	N/A	N/A
2	EIT2	33.49	N/A	36.34	N/A	N/A	N/A	N/A	N/A
3	E1T3	28.66	N/A	36.39	N/A	N/A	N/A	N/A	N/A
4	E1C1	28.17	N/A	33.89	N/A	N/A	N/A	N/A	N/A
5	E1C2	26.50	N/A	--	N/A	N/A	N/A	N/A	N/A
6	E1C3	27.46	N/A	31.45	N/A	N/A	N/A	N/A	N/A
7	K1T1	27.84	N/A	27.45	N/A	N/A	N/A	N/A	N/A
8	K1T2	26.79	N/A	25.35	N/A	N/A	N/A	N/A	N/A
9	KIT3	32.35	N/A	35.54	N/A	N/A	N/A	N/A	N/A
10	K1C1	28.11	N/A	29.18	N/A	N/A	N/A	N/A	N/A
11	K1C2	25.12	N/A	24.79	N/A	N/A	N/A	N/A	N/A
12	K1C3	30.59	N/A	27.96	N/A	N/A	N/A	N/A	N/A
13	K2T1	26.79	N/A	29.06	N/A	N/A	N/A	N/A	N/A
14	K2T2	29.36	N/A	32.30	N/A	N/A	N/A	N/A	N/A
15	K2T3	31.40	N/A	34.33	N/A	N/A	N/A	N/A	N/A
16	K2C1	26.21	N/A	29.89	N/A	N/A	N/A	N/A	N/A
17	K2C2	36.09	N/A	40.53	N/A	N/A	N/A	N/A	N/A
18	K2C3	30.61	N/A	28.37	N/A	N/A	N/A	N/A	N/A
19	K3T1	30.23	N/A	27.63	N/A	N/A	N/A	N/A	N/A
20	K3T2	34.16	N/A	36.08	N/A	N/A	N/A	N/A	N/A
21	K3T1A	25.34	N/A	24.94	N/A	N/A	N/A	N/A	N/A
22	K3C1	27.41	N/A	27.96	N/A	N/A	N/A	N/A	N/A
23	K3C2	29.78	N/A	32.08	N/A	N/A	N/A	N/A	N/A
24	P1T1	24.82	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25	P1T2	29.63	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26	P1T3	33.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A
27	P1T3A	33.78	N/A	N/A	N/A	N/A	N/A	N/A	N/A
28	P1C1	34.35	N/A	44.79	N/A	N/A	N/A	N/A	N/A
29	P1C2	34.96	N/A	49.90	N/A	N/A	N/A	N/A	N/A
30	P1C3	37.15	N/A	46.74	N/A	N/A	N/A	N/A	N/A
31	P2T1	27.63	N/A	36.71	N/A	N/A	N/A	N/A	N/A
32	P2T2	33.96	N/A	34.57	N/A	N/A	N/A	N/A	N/A
33	P2C1	34.73	N/A	N/A	N/A	N/A	N/A	N/A	N/A
34	P2C2	30.21	N/A	N/A	N/A	N/A	N/A	N/A	N/A
35	P3T1	37.44	N/A	40.62	N/A	N/A	N/A	N/A	N/A
36	P3T2	32.07	N/A	52.45	N/A	N/A	N/A	N/A	N/A
37	P3C1	25.51	N/A	35.70	N/A	N/A	N/A	N/A	N/A
38	P3C2	34.37	N/A	46.07	N/A	N/A	N/A	N/A	N/A

Available Moisture Holding Capacity (% by Mass) 15–30 cm Depth 100 mB SWEEP Benchmarks – Annual and S

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	27.74	N/A	28.51	N/A	N/A	N/A	N/A	N/A
2	EIT2	32.29	N/A	28.50	N/A	N/A	N/A	N/A	N/A
3	E1T3	26.66	N/A	29.77	N/A	N/A	N/A	N/A	N/A
4	E1C1	26.46	N/A	24.41	N/A	N/A	N/A	N/A	N/A
5	E1C2	24.93	N/A	––	N/A	N/A	N/A	N/A	N/A
6	E1C3	25.99	N/A	24.26	N/A	N/A	N/A	N/A	N/A
7	K1T1	24.51	N/A	25.13	N/A	N/A	N/A	N/A	N/A
8	K1T2	24.25	N/A	21.61	N/A	N/A	N/A	N/A	N/A
9	KIT3	27.28	N/A	26.68	N/A	N/A	N/A	N/A	N/A
10	K1C1	25.33	N/A	23.40	N/A	N/A	N/A	N/A	N/A
11	K1C2	21.69	N/A	22.29	N/A	N/A	N/A	N/A	N/A
12	K1C3	28.01	N/A	23.93	N/A	N/A	N/A	N/A	N/A
13	K2T1	24.25	N/A	22.12	N/A	N/A	N/A	N/A	N/A
14	K2T2	26.60	N/A	21.49	N/A	N/A	N/A	N/A	N/A
15	K2T3	25.16	N/A	22.32	N/A	N/A	N/A	N/A	N/A
16	K2C1	25.29	N/A	23.83	N/A	N/A	N/A	N/A	N/A
17	K2C2	32.79	N/A	27.91	N/A	N/A	N/A	N/A	N/A
18	K2C3	26.91	N/A	20.95	N/A	N/A	N/A	N/A	N/A
19	K3T1	27.92	N/A	22.59	N/A	N/A	N/A	N/A	N/A
20	K3T2	29.82	N/A	25.22	N/A	N/A	N/A	N/A	N/A
21	K3T1A	23.85	N/A	19.79	N/A	N/A	N/A	N/A	N/A
22	K3C1	26.27	N/A	23.93	N/A	N/A	N/A	N/A	N/A
23	K3C2	26.41	N/A	25.48	N/A	N/A	N/A	N/A	N/A
24	P1T1	21.65	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25	P1T2	23.96	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26	P1T3	29.29	N/A	N/A	N/A	N/A	N/A	N/A	N/A
27	P1T3A	29.09	N/A	N/A	N/A	N/A	N/A	N/A	N/A
28	P1C1	28.88	N/A	28.72	N/A	N/A	N/A	N/A	N/A
29	P1C2	28.47	N/A	30.62	N/A	N/A	N/A	N/A	N/A
30	P1C3	32.26	N/A	29.25	N/A	N/A	N/A	N/A	N/A
31	P2T1	23.20	N/A	25.74	N/A	N/A	N/A	N/A	N/A
32	P2T2	29.33	N/A	26.63	N/A	N/A	N/A	N/A	N/A
33	P2C1	31.68	N/A	N/A	N/A	N/A	N/A	N/A	N/A
34	P2C2	26.22	N/A	N/A	N/A	N/A	N/A	N/A	N/A
35	P3T1	27.30	N/A	29.53	N/A	N/A	N/A	N/A	N/A
36	P3T2	25.56	N/A	31.63	N/A	N/A	N/A	N/A	N/A
37	P3C1	23.14	N/A	25.87	N/A	N/A	N/A	N/A	N/A
38	P3C2	26.80	N/A	27.63	N/A	N/A	N/A	N/A	N/A

Available Moisture Holding Capacity (% by Mass) 15–30 cm Depth 15 Bar SWEEP Benchmarks – Annual and S

Site Code	Site Name	Annual 1989	Annual 1990	Annual 1991	Seasonal Post Plant 1990	Seasonal Post Harvest 1990	Seasonal Pre–plant 1991	Seasonal Post Plant 1991	Seasonal Post Harvest 1991
1	EITI	24.73	N/A	20.07	N/A	N/A	N/A	N/A	N/A
2	EIT2	28.83	N/A	20.42	N/A	N/A	N/A	N/A	N/A
3	E1T3	24.20	N/A	20.65	N/A	N/A	N/A	N/A	N/A
4	E1C1	24.28	N/A	15.09	N/A	N/A	N/A	N/A	N/A
5	E1C2	22.33	N/A	– –	N/A	N/A	N/A	N/A	N/A
6	E1C3	23.57	N/A	15.20	N/A	N/A	N/A	N/A	N/A
7	K1T1	21.70	N/A	18.87	N/A	N/A	N/A	N/A	N/A
8	K1T2	22.43	N/A	15.15	N/A	N/A	N/A	N/A	N/A
9	KIT3	21.17	N/A	12.31	N/A	N/A	N/A	N/A	N/A
10	K1C1	21.69	N/A	17.26	N/A	N/A	N/A	N/A	N/A
11	K1C2	18.63	N/A	16.54	N/A	N/A	N/A	N/A	N/A
12	K1C3	25.61	N/A	17.51	N/A	N/A	N/A	N/A	N/A
13	K2T1	22.43	N/A	13.80	N/A	N/A	N/A	N/A	N/A
14	K2T2	21.12	N/A	7.37	N/A	N/A	N/A	N/A	N/A
15	K2T3	19.27	N/A	9.45	N/A	N/A	N/A	N/A	N/A
16	K2C1	22.26	N/A	17.44	N/A	N/A	N/A	N/A	N/A
17	K2C2	28.78	N/A	15.57	N/A	N/A	N/A	N/A	N/A
18	K2C3	24.80	N/A	8.22	N/A	N/A	N/A	N/A	N/A
19	K3T1	24.33	N/A	15.56	N/A	N/A	N/A	N/A	N/A
20	K3T2	25.05	N/A	13.50	N/A	N/A	N/A	N/A	N/A
21	K3T1A	19.59	N/A	14.48	N/A	N/A	N/A	N/A	N/A
22	K3C1	23.36	N/A	17.51	N/A	N/A	N/A	N/A	N/A
23	K3C2	21.81	N/A	18.42	N/A	N/A	N/A	N/A	N/A
24	P1T1	17.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25	P1T2	15.81	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26	P1T3	23.11	N/A	N/A	N/A	N/A	N/A	N/A	N/A
27	P1T3A	22.51	N/A	N/A	N/A	N/A	N/A	N/A	N/A
28	P1C1	21.93	N/A	12.62	N/A	N/A	N/A	N/A	N/A
29	P1C2	22.25	N/A	12.20	N/A	N/A	N/A	N/A	N/A
30	P1C3	26.07	N/A	12.50	N/A	N/A	N/A	N/A	N/A
31	P2T1	17.85	N/A	12.15	N/A	N/A	N/A	N/A	N/A
32	P2T2	22.00	N/A	15.60	N/A	N/A	N/A	N/A	N/A
33	P2C1	18.81	N/A	N/A	N/A	N/A	N/A	N/A	N/A
34	P2C2	20.21	N/A	N/A	N/A	N/A	N/A	N/A	N/A
35	P3T1	20.27	N/A	18.47	N/A	N/A	N/A	N/A	N/A
36	P3T2	23.01	N/A	19.15	N/A	N/A	N/A	N/A	N/A
37	P3C1	19.25	N/A	11.72	N/A	N/A	N/A	N/A	N/A
38	P3C2	22.32	N/A	14.90	N/A	N/A	N/A	N/A	N/A

AG–CANADA SWEEP PROJECT
SOIL DATA ANALYSIS

FILE – 50AMUDIF

SPM–MARCH 6/92

AVAILABLE
0–15CM

SITE NAME	SELECTED PAR	1989 % DIFFERENCE BY VOLUME	% DIFFERENCE BY VOLUME
K1T1	AMH (0–15cm)	3.63	12.28
K1T2	AMH (0–15cm)	5.36	17.84
KIT3	AMH (0–15cm)	5.20	19.27
K1C1	AMH (0–15cm)	8.45	14.14
K1C2	AMH (0–15cm)	4.68	8.91
K1C3	AMH (0–15cm)	6.36	15.54
K2T1	AMH (0–15cm)	4.15	12.82
K2T2	AMH (0–15cm)	24.10	20.13
K2T3	AMH (0–15cm)	5.51	16.08
K2C1	AMH (0–15cm)	4.13	13.65
K2C2	AMH (0–15cm)	5.17	18.48
K2C3	AMH (0–15cm)	3.62	23.76
K3T1	AMH (0–15cm)	4.36	14.65
K3T2	AMH (0–15cm)	6.28	19.79
K3T1A	AMH (0–15cm)	6.21	8.55
K3C1	AMH (0–15cm)	10.14	10.12
K3C2	AMH (0–15cm)	4.67	16.04
P1T1	AMH (0–15cm)	12.38	14.44

APPENDIX C
AGRONOMIC MONITORING METHODS

C1.0 SOIL SAMPLING

Purpose:

To determine soil fertility level per field.

Schedule:

Once a year, preferably in the fall.

Materials:

- soil probe
- plastic pail
- screwdriver
- prelabelled soil sample boxed with plastic bag inserts
- watershed map with acres of each field indicated
- pencil

Exception:

- winter wheat sampled in August after harvest
- hay/alfalfa/pasture not sampled

Methodology:

1) With the soil probe perpendicular to the ground, insert to a depth of 15 cm and twist 90°.
2) Pull the probe straight up, careful not to lose any of the sample.
3) Using the screwdriver, remove the soil from the probe into the plastic pail.

4) Take representative samples in a zigzag pattern from various locations for each field. Take at least 20 samples for each 12 acre (5 ha) field, and proportionately more cores for larger fields.
5) Mix the contents of the plastic pail thoroughly until all soil is of a uniform size.
6) Assemble the soil sample box and insert the plastic bag.
   Fill the bag with soil from the pail, fold the bag and close the box.
7) Record the field sampled by checking it off on a watershed map.

Note: Each sample (box) should not represent more than 25 acres (10 ha). Therefore, more than one box may be required for larger fields. When this happens, be sure to label each box with a letter (A, B, C...) in addition indicate on the map where each sample box was sampled from within the field.

C2.0 CROP RESIDUE COUNTS

Purpose:
To determine the amount of soil surface residue coverage per field.

Schedule:
Fall (after harvest, before tillage)
Early spring (after spring runoff but before spring field work)
Late spring (after planting)

Materials:
- nylon rope knotted every 15 cm (50 knots long)
- 2 screwdrivers
- data collection sheet on clipboard, watershed map with field numbers and acres marked on

Exceptions:
- winter wheat sampled 2x per year:
  1) Fall (just before snowfall)
  2) March/April
- hay/alfalfa/pasture not to be sampled

Note: When counting residue level in a wheat field the stalk has to be touching the knot in order to be counted!!!

Methodology:

Before entering the field, ensure the cooperator has given approval. Clean boots and clothing of mud and weed seeds.

Enter a field at a convenient location and randomly select a sampling area at least 10 m from the field edge. Avoid depressions and headlands.

Attach the screwdrivers to each end of the knotted rope. Insert one screwdriver into the ground and place the other end diagonally across the direction of planting or tillage.

Straddle the rope and walk slowly along its length. Look straight down at the knots on the rope and count the number of times a piece of residue intercepts or touches a knot (do not include stones). The general 'rule of thumb' is that a piece of residue must be big enough to intercept a raindrop to be counted. If you have any doubt whether the point intersects residue, don't count it.

Record the number of intercepts on the data sheet and at the approximate location on the cooperator field map.

Repeat the process at various locations throughout the field. By referring to the polygon map, representative samples should be taken from within areas of similar elevation, slope and soil type.

The number of sampling counts is dependent on field acreage:

3 counts on 0-10 acres
1 count for every additional 5 acres

Take the average of the data recorded for each field and multiply by two to get the % residue cover.

C3.0 CROP SCOUTING

C3.1 Field Priorities When Crop Scouting

The results of your crop scouting must satisfy the needs of both the producer and the project.

For the producer, crop scouting is an important service of the Pilot Watershed Project. Your scouting reports will act as either a check that weed and disease levels have been maintained at an economically acceptable level, or will notify him as to potential problems in his fields. In either case, just knowing that his fields are being monitored will give the producer the reassurance that the PWS is looking after his best interest. In this sense, the crop scouting service is especially valuable to producers implementing conservation measures for the first time, as these are the ones most likely to have concerns.

In terms of the project, crop scouting supplies data that will be used in the final assessment of conservation measures. The weed and disease ratings from the test and control watershed will be compared, but this is only possible if fields representing a range of crops and tillage practices are monitored in both the test and control watersheds.

Keeping these points in mind, the following list has been prepared to indicate the priority of fields for crop scouting.

1. Co-operators' fields in the test watershed, where the co-operator has implemented conservation measures for the first time.
2. Co-operators' fields in the control watershed, with similar one year crop history as those fields scouted in the test watershed (#1).
3. Co-operators' fields in the test watershed where conservation measures have been followed.
4. Co-operators' fields in the control watershed, with similar one-year crop history as those fields scouted in the test watershed (#3).
5. Co-operators' fields in the test watershed where conservation measures have not been followed.
6. Co-operators' fields in the control watershed that have not yet been scouted.
7. Non-co-operators' fields in the test watershed.
8. Non-co-operators' fields in the control watershed.

C3.2 Crop Scouting Methodology

Each field scouted is to be reported on a separate data sheet. A template form for the report is provided (Figure 1.0). Always carry this with you to ensure that your format is consistent and that no information is missed.

Weed surveying and mapping

Methodology

Before entering a field, record the co-operator and field number, crop and date on the crop scouting data sheet. Draw a map of the field indicating compass direction (north) and any points of reference such as trees or buildings.

Enter the field at a convenient location and randomly select a sampling area at least 20 m into the field. Insert a flag 12 inches (30 cm) from one row. Measure 10 feet (3 m) along the row and mark this spot with another flag. Measure an equal area of 1 foot by 10 feet on the opposite side of the row and mark each corner with a flag.

The weeds within the area are to be recorded under four different classifications:

Annual Grasses
Perennial Grasses,
Annual Broadleaf Weeds
Perennial Broadleaf Weeds.

A list of the more common weeds in Ontario within each classification is given in Section C3.3.

Refer to your reference material to make the necessary identifications.

Record the intensity of each classification of weeds on the data sheet using the following rating scheme:

1 = None - No weeds present
2 = Few - Very few, 1-3 weeds/sampling

3 = Common - Scattered, 4-7 weeds/sampling
4 = Abundant - Uniform, 8-20 weeds/sampling
5 = Extreme - >20 Broadleaf weeds/sampling
60 Grass weeds/sampling

With practice, you will be able to visually estimate these intensity ratings. Until you are fully confident, however, be sure to do a count for at least the first stop in each field.

Beside each number recorded on the data sheet, indicate which species were observed and included in the general rating.

Indicate the sampling area on the field map by marking it with the letter corresponding to the stop number (ie. A = first stop).

Proceed walking across the field in a zig-zag pattern. The number of random stops required varies depending upon the size of the field:

- 3 stops on 0-10 acres
- 1 stop for every additional 5 acres to a maximum of 8 stops in a field.

Calculate the average rating for each weed classification and record this on the data sheet.

In addition to marking the sampled areas on the map, you may circle areas of heavy infestation of a particular species. This may be of benefit to the co-operator. Also, at the bottom of the data sheet you may make any notes that will help to describe the weed situation in the field, or further explain your ratings. If you have a general impression of the field, it may be recorded here.

While scouting for weeds, you should also make note of any disease or insect infestations. These may also be recorded at the bottom of the sheet. Indicate where the pest was observed (which stop) and give an indication of the severity. A list of economically important insect and disease pests is given in Section C3.4.

The white copy of the data sheet is to be given to the co-operator, the pink copy is kept in your files, and the yellow copy is to be sent to the office.

Schedule

The time to scout for weeds is determined by the crop.

Crop	# Scoutings	Time
Spring cereals	1	Early May
Winter wheat	1	Early May
Grain corn	2	Early - Mid May Late May - Early June
Soybeans	1	Late May - Early June

C3.3 Examples of Common Weeds in Ontario

Annual Grasses

Foxtails, witchgrass, fall panicum, crab grass, wild oats, barnyard grass, proso millet

Perennial Grasses

quackgrass, yellow nutsedge

Annual Broadleaf Weeds

pigweed, lambs-quarters, ragweed, chickweed, wild mustard, stinkweed, shepherd's purse, velvetleaf, nightshade, wild buckwheat, wild carrot, common mallow

Perennial Broadleaf Weeds

Canada thistle, field bindweed, dandelion, field horsetail, yellow rocket, milkweed, curled dock, broad-leaved plantain, narrow-leaved plantain

C3.4 Economically Important Insect and Disease Pests

Crop PESTS

Corn

i) Diseases
- seedling diseases (e.g. Pythium spp, Fusarium spp, soil conditions)
- Anthracnose
- Eyespot
- Northern leaf blight and leaf spot
- Bacterial leaf blight (Stewart's Wilt)
- Head smut
- Giberella stalk rot
- Giberella ear rot

ii) Insects
- White grub
- Seed corn maggot
- Wireworm
- Cutworm
- Slugs
- Corn rootworm
- European corn borer
- Armyworm
- Corn leaf aphid

Soybean

i) Diseases
- Phytophthora root rot
- Rhizoctonia root rot
- Powdery mildew
- Downy mildew
- Pod and Stem blight

ii) Insects . Mites
. Green cloverworm

Barley

i) Diseases . Seedling blight
. Loose smut
. Scald
. Net blotch
. Spot blotch
. Take-all

ii) Insects . Wireworms
. Armyworm
. Cereal leaf beetle

Oats

i) Diseases . Septoria leaf blotch
. Oat leaf rust
. Cereal leaf beetle

ii) Insects . Wireworms
. Armyworm
. Cereal leaf beetle

Alfalfa

i) Diseases . Verticillium wilt
. Leaf spot, common
. Anthracnose
. Phytophthora root rot
. Fusarium root rot and crown rot

ii) Insects

- Alfalfa weevil
- Alfalfa blotch leaf miner
- Potato leaf hopper
- Armyworm

Winter Wheat

i) Diseases

- Wheat spindle streak mosaic
- Snow mould
- Septoria leaf spot
- Septoria glume blotch
- Fusarium head blight
- Fusarium seedling blight
- Powdery mildew
- Eyespot
- Tan spot
- Sharp eyespot
- Take-all
- Leaf rust
- Stem rust
- Pythium root rot

ii) Insects

- Wireworms
- Army worms
- Cereal leaf beetle

C3.5 Scouting for Powdery Mildew in Winter Wheat

There have been reports of powdery mildew in winter wheat fields within the watersheds. We would like to have an estimate of the intensity of the disease in fields to allow a comparison between no-till and conventional practices.

Symptoms of the disease are the patches of white mycelium on the leaves resembling cushions of white powder. The disease intensity will range from just a few white flecks to patches or a blanket of white, cottony mycelium.

Begin by walking through a wheat field to look for evidence of the disease. You must decide which green leaf on the plants generally has the most disease. Count down from the top of the plant to determine the leaf number. The leaf you have chosen to rate will probably be the third or fourth, or higher if these are no longer green. Your ratings on all plants will now be based on the disease intensity on that numbered leaf.

Please scout both no-till and conventional tillage wheat fields in your watershed. In each field, sample 20 leaves (all the same leaf number on the plant) at 3-5 stops in the field (depending on the size). Each leaf will be rated on a scale of 1-5 as follows:

1 = no powdery mildew
2 = few, occasional white flecks
3 = patches of mycelium covering 0-5% of leaf area
4 = patches of mycelium covering 5-20% of leaf area
5 = patches of mycelium covering >20% of leaf area

Calculate the average rating for the 20 leaves at each stop.

Be sure to fill out a scouting report!

FIGURE C-3.1:EXAMPLE CROP SCOUTING DATA SHEET

Cooperator ______________

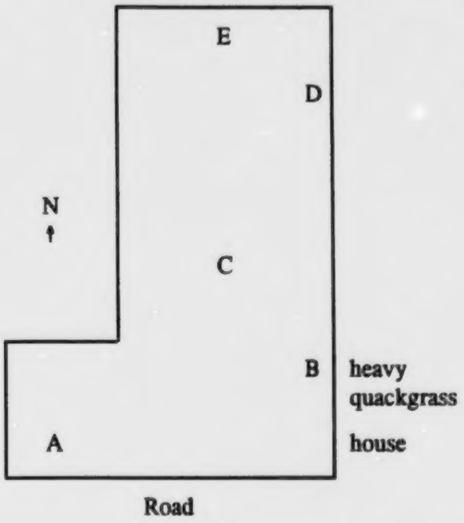
Date ______________

Field # ______________

Date ______________

Observer ______________

1 = None
2 = Few
3 = Common
4 = Abundant
5 = Extreme



Stop	Annual Grasses	Perennial Grasses	Annual Broadleaf	Perennial Broadleaf
A	2 - foxtails - witchgrass	1	1	1
B	1	5 - quackgrass - yellow nutsedge	2 - lambs-quarters	1
C	2 - fall panicum - witchgrass	3 - quackgrass	2 - lambs-quarters - redroot pigweed	2 - Canada thistle - field birdweed
D	1	2 - quackgrass	1	1
E	2 - foxtails - witchgrass	2 - quackgrass	2 - ragweed	1
F				
G				
H				
Average	1.6	2.6	1.6	1.2

Notes: Heavy quackgrass in areas
Annual broadleaf weeds often too small to identify
No disease problems
Few slugs observed at C

C4.0 FIELD CROP YIELD/MOISTURE CHECKS

Purpose:

To obtain a representative crop harvest yield of standard dry weight for a field or area.

Schedule:

Winter cereal harvest - July: Spring cereal harvest - August; Soybean harvest - September, October; Corn harvest - October, November.

Materials:

Weigh wagon, spare gasoline, moisture metre, flat surface, level, paper and pencil, measuring wheel, survey flags, calculator.

Methodology:

In preparation of weighing a representative strip within a field, headland areas are removed. Cooperator grain wagons or grain truck are positioned along a relatively level area of headland which the weigh wagon is pulled alongside. The auger tube should be raised before parking beside wagon or truck to allow the auger opening to be situated as close to the middle of the dumping area as possible. Ensure the auger door and clean out door are closed before weighing begins. Follow the Operating Procedure of the owners manual for the weigh wagon and the System Operation within the scale system owners manual. Zero the scale before each grain dump by pressing both the 'zero' and "total load" buttons simultaneously until zeros appear.

- Record the weight of the dumped grain.
- Take three samples of grain for moisture content from different areas in the weigh wagon and record the tester readings and temperature compensated readings. Follow the operation instructions in the Grain Moisture Tester Manual. Repeat moisture sampling with each dump.
- At full throttle, auger grain from weigh wagon as per instructions.

- A minimum of two samples per field should be weighed with a representative strip weighed every ten acres depending on cooperator wishes.
- Each strip should be measured with the measuring wheel if they are different lengths to calculate the sampling area of each grain weight.
- Survey flags can be used to mark strips if distances cannot be measured immediately.
- For solid-seeded cereal and soybean crops where header width is considered for the width of the sampling area, an optimum method is to strike out into an uncombined area to ensure sampling the full width of the combine header. Adjacent check strips should allow a loss of six inches in width for each pass.

- Yield is determined by the following calculations:

i)	to determine dry matter	weighed sample x (1 minus average final % moisture as a decimal value)
ii)	to determine standard dry weight	value from (i) divided by standard dry weight at standard crop moisture (Table C4.1) eg. corn = 1-0.155 = 0.845 (15.5% moisture)
iii)	to determine bushel weight	value from (ii) divided by standard bushel weight (Table C4.1) (lbs/bushel)
iv)	to determine yield/acre	value from (iii) divided by sampling area (acres)

Example - corn sample

i) 2,680 lbs x (1-0.224) = 2079.7 lbs
ii) 2079.7 lbs ÷ (1-0.155) = 2461.2 lbs
iii) 2461.2 lbs ÷ 56 lbs/bushels = 44.0 bushels
iv) 44.0 bushels ÷ 0.338 acres = 130.2 bushels/acre

Table C-4.1: Standard Crop Moisture Content and Test Weight

Crop	Standard Moisture %	Standard Test Weight (lbs/bu)
Corn	15.5	56
Soybean	14.0	60
White bean	18.0	60
Kidney bean	18.0	60
Wheat	14.5	60
Barley	14.8	48
Oats	14.0	34
Rapeseed	10.5	50
Canola	10.5	50
Flaxseed	10.5	
Sunflower	10.5	

C5.0 CROP RESIDUE AND GRAIN YIELD METHODOLOGY

C5.1 Crop Residue Measurements

The level of cover will be monitored at the seasonal benchmarks, of which there is only one in each watershed. These are as follows:

Watershed	Seasonal Benchmark	Field No.
Essex Control	E1C	103-3
Essex Test	E1T	116-2
Kettle Control	K2C	205-1
Kettle Test	K1T	216-1
Pittock Control	P1C	302-1
Pittock Test	P1C	314-3

Schedule:

Residue counts are made at each seasonal benchmark at three times in the year: after spring runoff, after planting, and fall post harvest (before tillage). These counts can thus be made at the same time as the corresponding field residue counts are made.

Materials:

Nylon rope knotted every 15 cm (50 knots total), two screwdrivers or flag posts, residue data collection sheets, watershed map with field numbers, soil benchmark maps, compass, measuring wheel.

Enter the field and locate the benchmark sub-sites identified on the map using your compass and measuring wheel. Following the methodology for crop residue counts outlined in Section C2.0 of this report, three counts are to be made at each benchmark sub-site location.

Record the results of the crop residue measurements at soil benchmarks on a separate residue data collection sheet so they will not be confused with the counts for the whole fields. On each sheet, clearly identify the field number, crop residue type, date, crop stage and benchmark sub-site number.

C5.2 Crop Yield Measurements

Crop yield is an annual measurement, to be taken at all soil benchmark monitoring locations. The exact timing of the measurement will vary with the crop type and the season. Yield sample collections must be made at crop maturity, but before the cooperator harvests.

All measurements of crop yields at soil benchmarks are made by hand harvesting representative samples of the crop from known areas. The methods of sample collection and analysis will therefore vary depending upon the crop in question.

Corn

At crop maturity, hand sample and shuck all ears from a 10.0 m length of row. Three such samples are collected at each benchmark sub-site from adjacent rows.

Each sample is weighed (TC), ten average cobs are selected, weighed (FC) and dried to a constant weight in a forced-air dryer at 80°C for about four days. The dried ears are subsequently weighed (DS) and shelled.

The shelled grain is again weighed (G). The final grain weight per sample, adjusted to kilograms per hectare at 15.5 % moisture content, is calculated using the following equation:

$$\text{Yield} = \frac{TC \times G}{FC} \quad \frac{kg}{7.62 m^2 *} \quad \times \quad \frac{10^4 m^2}{ha} \quad \times \quad \frac{100}{84.5}$$

* for 30 inch rows

From the same data the % moisture content at harvest was calculated as follows:

$$\%\ \text{Moisture Content} = \frac{FC-DR}{FC} \times 100$$

Soybeans, White Beans and Kidney Beans

At crop maturity, hand harvest all the above-ground plant material within the length of crop row equating to an area of one square metre. Three such samples are collected at each benchmark sub-site; each sample from an adjacent row. Should it be necessary to store the samples prior to threshing, the samples are placed in burlap bags to permit air movement. Should the samples require drying prior to being threshed, they are placed in the forced-air dryer for the required period of time.

Each sample is threshed and the resulting beans are cleaned to remove any debris. The beans from each sample are then weighed and the moisture content measured using a moisture meter. The resulting yield weights adjusted to kilograms per hectare at the standard moisture content (soybean - 14.0%; white bean and kidney bean - 18.0%) are calculated using the following equation:

$$\frac{\text{sample bean weight (kg/m}^2\text{)} \quad \text{X} \quad \left(1 - \frac{\text{bean \% moisture content}}{100}\right)}{1 - \frac{\text{standard \% moisture content}}{100}} \quad \text{X} \quad 10^4 \text{ m}^2\text{/ha}$$

Cereals

At crop maturity, hand harvest all the above-ground plant material within one square metre using a sickle. Three such samples are collected at each benchmark sub-site. Each sample is threshed and the resulting grain is cleaned to remove any debris. The grain from each sample is then weighed and the moisture content measured using a moisture meter. The resulting yield weights adjusted to kilograms per hectare at the standard moisture content (barley - 14.8%; oats - 14.0%; mixed grain - 14.4%) are calculated using the following equation:

$$\frac{\text{sample grain weight (kg/m}^2\text{)} \quad \text{X} \quad \left(1 - \frac{\text{grain \% moisture content}}{100}\right)}{1 - \frac{\text{standard \% moisture content}}{100}} \quad \text{X} \quad 10^4 \text{ m}^2\text{/ha}$$

APPENDIX D
AGRONOMIC RAW DATA

This Appendix contains a printout of the agronomic data collected during the life of the Pilot Watershed Study (a disk copy is included in the sleeve at the end of the appendix). The following information will assist the user in fully understanding and utilizing the data.

Field Numbers

Each field was assigned a number at the beginning of the program, however due to changes in field boundaries and owners/tenants the field numbers may have changed as the project proceeded. The data for each field were entered along the same row in the spreadsheet throughout the years. This explains why there are extra rows in the database. Please refer to the attached 1989/90 field boundary maps for an example of the field locations within each sub-watershed.

There were two watersheds, control and test, within each of the areas chosen for study. With regard to field numbering, Essex watershed fields were the 100 level, Kettle the 200 level and Pittock the 300 level. In the printouts the control fields are listed first in each of the watersheds. It becomes somewhat confusing in the Kettle watershed as the same cooperators have land in both the test and control watersheds. The difference in these fields is that either the control or test fields have a **C** or **T** after the field number, respectively. Referring to the maps will also assist in defining the test and control fields.

Acreages

Acreages of the fields were based on the cooperators estimations. The area reported was the size of the field that was actually within the boundary of the watershed study area.

Crops and Tillage

The crops and tillage were assigned numbers in order to assist in the sorting of the data. A key is given on the next page that indicates the numerical equivalent of the crop or tillage.

Secondary tillage data are given as they occurred in the field, i.e. if the cooperator cultivated three times in one day the entry would be 6/6/6, but if the field was cultivated on three separate days the entry would appear in separate columns as 6 6 6.

Live and Dead Residue Cover

The knotted rope method was use to measure the **actual** percent soil surface live and dead residue cover (referred to as **Cover** in the data). Data were collected after spring runoff but prior to spring tillage (appears as 04/9? in the printout); after planting (06/9?); after harvest but prior to fall tillage (09/9?) and after primary tillage (10/9?).

Soil surface cover levels were also **estimated** by Ecologistics Limited staff based on previous crop and tillage practices. The assumptions used are outlined after the table.

Yield Data

Yield data were derived from three sources: elev = elevator slips; est = cooperator estimate; and ww = weigh wagon performed by the watershed technician. In calculating the yield information presented in the final report only the elevator slip and weigh wagon information was used. The area used in calculating the yield from elevator slips was the cooperator field size estimate. The area used in calculating the yield from the weigh wagon was obtained from the combine header width and an actual measurement (with measuring wheel) of the length of area harvested.

Key #	Crop Key	Primary Tillage Key	Secondary Tillage Key
1	- Silage corn	- Moldboard plough	- Disc
2	- Sweet corn	- Adjusted moldboard plough (trash covers removed)	- Harrow-drag or mounted
3	- Field corn	- Cut-off or modified moldboard	- Packer
4	- Soybeans	- Chisel plough	- Rotary hoe
5	- White beans	- Disc/coulter chisel with twisted shovels	- Inter-row cultivate
6	- Field peas	- Disc/coulter with sweeps	- C-tine cultivator
7	- Winter wheat not underseeded	- Cultivator	- S-tine cultivator
8	- Oats not underseeded	- Disc	- Cultipacker
9	- Barley not underseeded	- No fall tillage	- Cultimulcher
10	- Winter wheat underseeded	- No till	- Spring moldboard
11	- Oats underseeded	- Packer/harrow	- Land leveller
12	- Barley underseeded	- Inter-row cultivation	- Furrow plough
13	- Canola	- Other	- Spring chisel
14	- Winter rapeseed	- Hay or pasture field - no tillage	
15	- Hay alfalfa		
16	- Hay other		
17	- Pasture		
18	- Other cover crops (includes hairy vetch)		
19	- Other		
20	- Winter wheat stubble underseeded		
21	- Winter wheat stubble not underseeded		
22	- Sunflower		
23	- None/fallow		
24	- Kidney beans		
25	- Mixed grain not underseeded		
26	- Mixed grain underseeded		
27	- Field corn underseeded		
28	- Natto beans		
29	- Cranberry beans		
30	- Snap beans		
31	- Research plots		
32	- Seeded down critical area		
33	- Brown beans		

ASSUMPTIONS USED FOR ESTIMATING RESIDUE LEVELS

The following assumptions have been made when estimating live and dead cover.

When a residue cover estimate is made the midpoint of each percent cover range is used, i.e. 0-9% = 5%; 10-19 = 15%; 20-29 = 25%; 30-39% = 35%; and >40% = 70%.

CROP RESIDUE

- All crops except silage corn and fallow will leave >40% post harvest residue cover.
- Fields of grain corn, soybeans or sunflowers will leave 0-9% cover in June when planted into fields that had 0-9% cover in early spring before any secondary tillage.
- Fields of grain corn will leave 0-9% cover in June when planted into fields that had 10-19% cover in early spring when the secondary cultivation is unknown.

Corn

- Fall chisel ploughing with sweeps or twisted shovels, after grain corn will leave >40% cover in early spring before any secondary tillage is done.
- Fall chisel ploughing after grain corn followed by 2 cultivations will leave 30-39% residue in June if >40% residue was measured after spring runoff.

Beans

- Fall chisel ploughing with sweeps or twisted shovels, after soybeans or kidney beans will leave 0-9% cover in early spring before any secondary tillage is done.
- Fall discing or cultivating after soybeans followed by winter wheat will leave 30-39% cover in early spring.

Spring Grains

- Fall chisel ploughing with twisted shovels after spring grains followed by winter wheat will leave >40% cover in early spring.
- Fall chisel ploughing with sweeps after spring grain will leave 30-39% residue cover in early spring.

Winter Wheat

- Fall chisel ploughing after winter wheat that has been underseeded to alfalfa will leave >40% cover in early spring before any secondary tillage.
- Regardless of tillage winter wheat in April will leave >40% cover.
- Winter wheat stubble spring moldboard ploughed followed by 2 cultivations will leave 10-19% residue in June.

Hay, Alfalfa, Pasture

- Fields of established hay, alfalfa and pasture will leave >40% cover at all times within the year.
- Fields of grain corn will leave >40% cover in June when planted no-till into alfalfa.
- Fall ploughing hay will leave 10-19% residue cover in early spring.
- Spring moldboard ploughing pasture followed by 4 spring cultivations will leave a residue level of 10-19% in June.

Other

- Bush, residential areas and farm yards will leave >40% cover at all times within the year.
- Residue cover in the Pioneer plots (319) does not change between 04/90 and 06/90 due to the mix of crops.

TILLAGE PRACTICES

Fall Moldboard Plough

- Fall moldboard ploughing after soybeans, silage corn, grain corn, winter wheat, spring grains, or hay alfalfa will leave 0-9% cover in early spring before any secondary tillage is done.
- For non-cooperators it is assumed that fall moldboard ploughing was the primary tillage if not indicated otherwise.
- If the primary tillage is fall moldboard ploughing and the previous crop and April residue count is unknown then the residue cover will be 0-9% in 04/90 and 06/90.

Spring Moldboard Plough

Fields of grain corn or soybeans will leave 0-9% cover in June when planted following spring moldboard ploughing.

Spring Chisel Ploughing

- Fields of grain corn will leave 0-9% cover in June when planted following spring chisel ploughing and cultivation.

Spring Cultivation

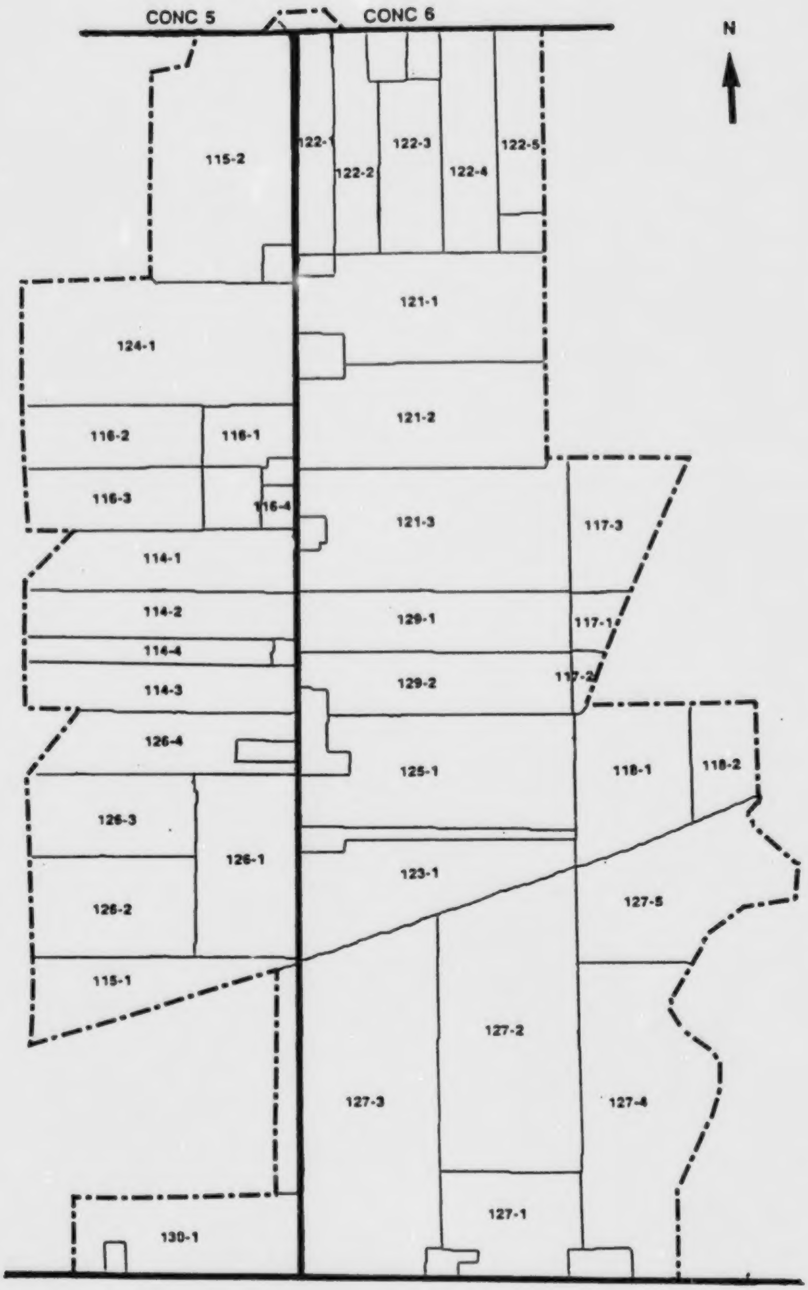
- Fields of grain corn will leave 10-19% cover in June when planted into fields that had 20-29% cover in early spring before being cultivated twice.
- Fields of grain corn will leave 10-19% cover in June when planted into fields that had 10-19% cover in early spring before being cultivated once.
- Fields of grain corn will leave 20-29% cover in June when planted into fields that had 30-39% cover in early spring before being cultivated once.
- Fields of field peas, soybeans or white beans will leave 0-9% cover in June when planted into fields that had 0-19% cover in early spring before being cultivated three times.
- Fields of soybeans will leave 20-29% cover in June when planted into fields that had >40% cover in early spring before being cultivated three times.
- Fields of kidney beans will leave 0-9% cover in June when planted into fields that had 20-29% cover in early spring before being cultivated three times.

General

- Fields of winter wheat or spring cereals will leave >40% cover in June, regardless of tillage system used.
- Since the 1989 crop and primary tillage are unknown for fields 212-1, 212-2 and 130-1 only a very rough estimated could be made.

OTHER

- Fields with the same cooperator, crop and tillage history will leave similar levels of cover.
- No previous crop or tillage information and only partial residue information is available for fields 108 and 101. Therefore assumptions were made based in observations and personal experience.
- No fall tillage has been assumed for fields 222-1 and 222-2 due to the high residue cover in 04/90.
- Since non-cooperator 330 is a livestock farmer it is assumed that spring grain was grown in 1990.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CONC 6
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121-2
116-3
116-4
121-3
117-3
114-1
114-2
129-1
117-1
114-4
114-3
129-2
117-2
126-4
125-1
118-1
118-2
126-3
126-1
123-1
127-5
126-2
115-1
127-2
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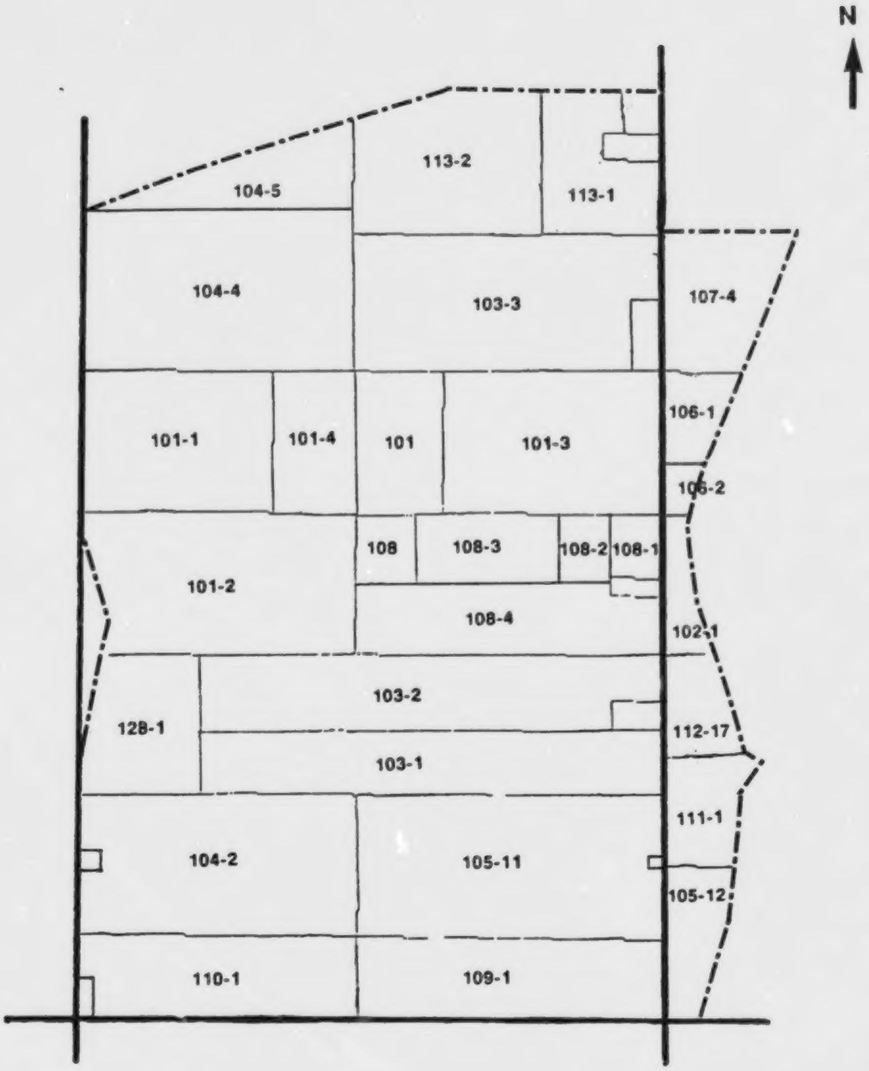
127-4
127-1
130-1

ESSEX TEST SUB-WATERSHED

Field Boundaries (Crop Year 1989-90)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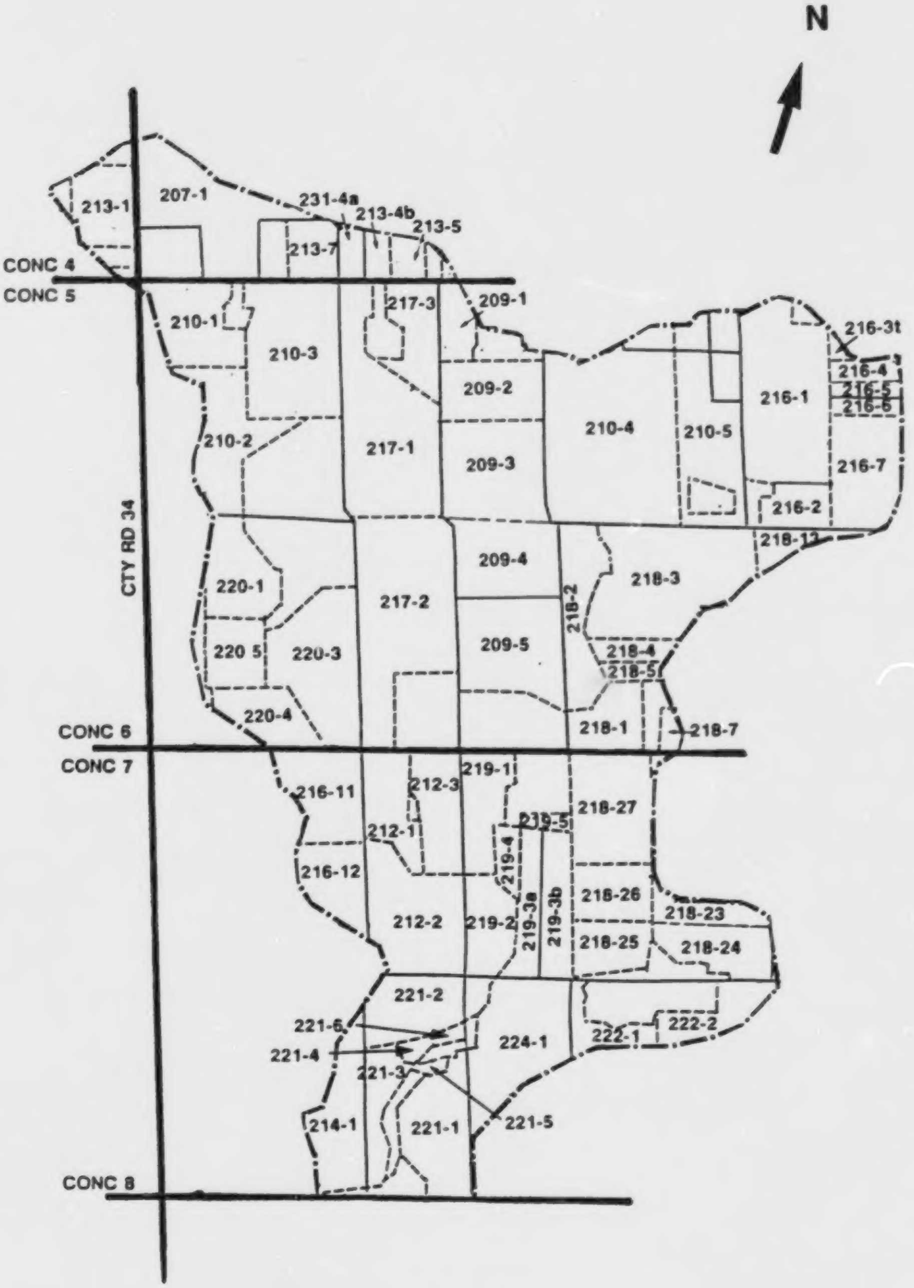
108-2
108-1
101-2
108-4
102-1
128-1
103-2
112-17
103-1
111-1
104-2
105-11
105-12
110-1
109-1

ESSEX CONTROL SUB-WATERSHED

Field Boundaries (Crop Year 1989-90)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CONC 5
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216-3t
216-4
216-5
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209-2
216-1
210-4
210-5
210-2
217-1
209-3
216-7
216-2
CTY RD 34
218-12
209-4
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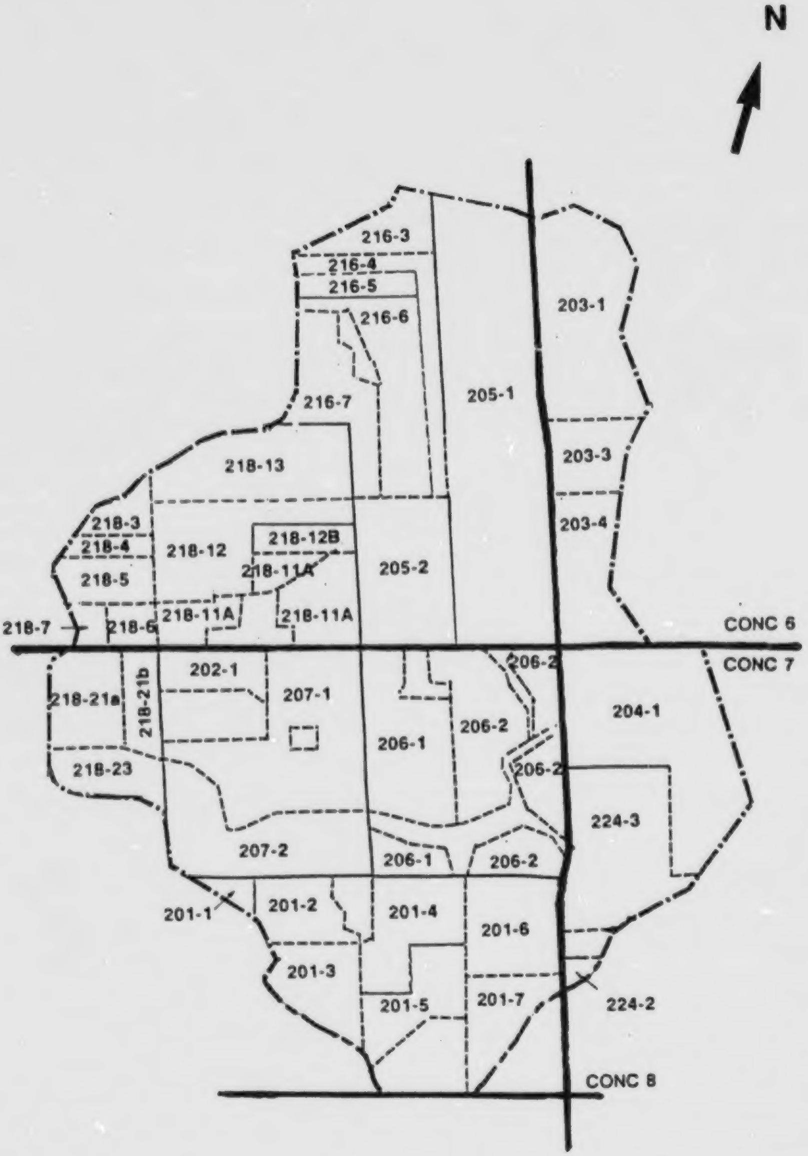
220-1
217-2
218-2
209-5
220 5
220-3
218-4
218-5
220-4
CONC 6
218-1
218-7
CONC 7
219-1
212-3
216-11
218-27
219-5
212-1
219-4
216-12
218-26
219-3a
219-3b
218-23
212-2
219-2
218-25
218-24
221-2
221-6
222-2
224-1
222-1
221-4
221-3
214-1
221-1
221-5
CONC 8

KETTLE TEST SUB-WATERSHED

Field Boundaries (Crop Year 1989-90)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218-12
218-12B
218-11A
205-2
218-7
218-6
218-11A
218-11A
CONC 6
CONC 7
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202-1
207-1
218-21a
218-21b
206-1
206-2
204-1
218-23
206-2
224-3
207-2
206-1
206-2
201-1
201-2
201-4
201-6
201-3
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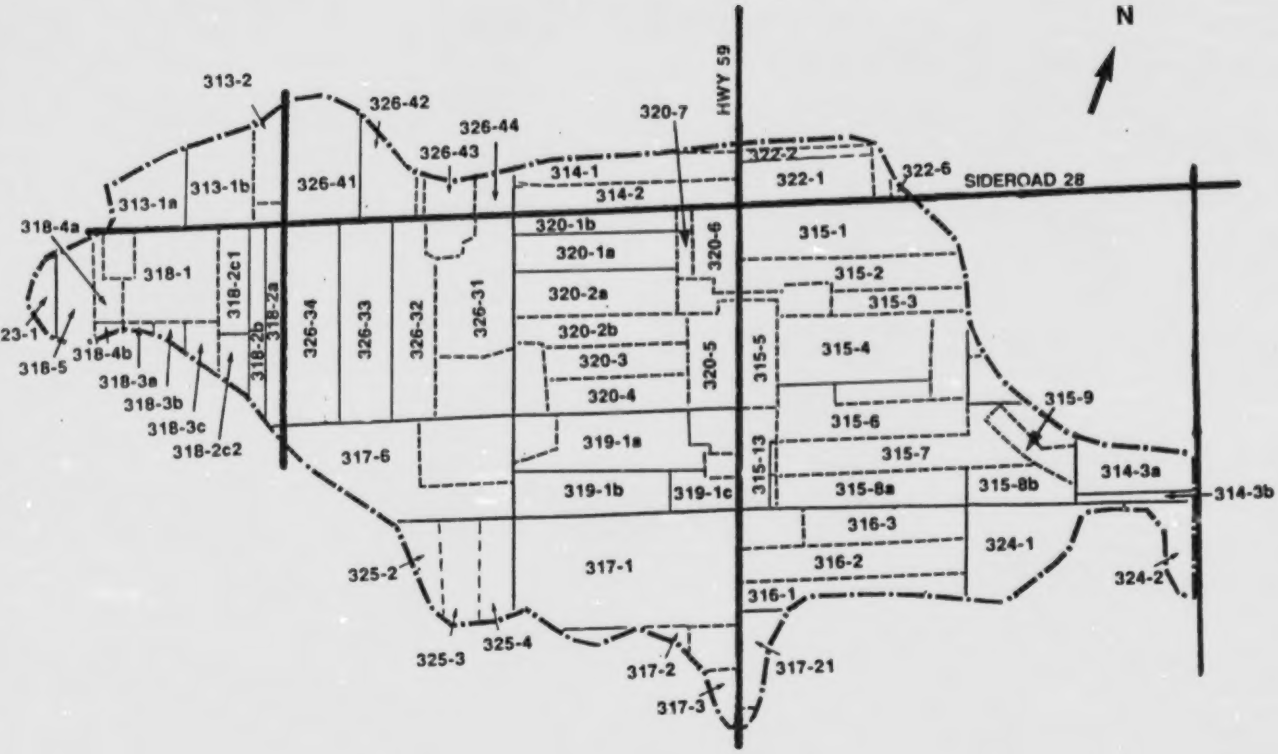
201-7
224-2
CONC 8

KETTLE CONTROL SUB-WATERSHED

Field Boundaries (Crop Year 1989-90)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322-2
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314-1
314-2
322-1
318-4a
320-1b
320-1a
320-6
315-1
318-1
318-2c1
318-2a
326-34
326-33
326-32
326-31
320-2a
315-2
315-3
323-1
318-5
318-4b
318-3a
318-3b
318-3c
318-2c2
318-2b
320-2b
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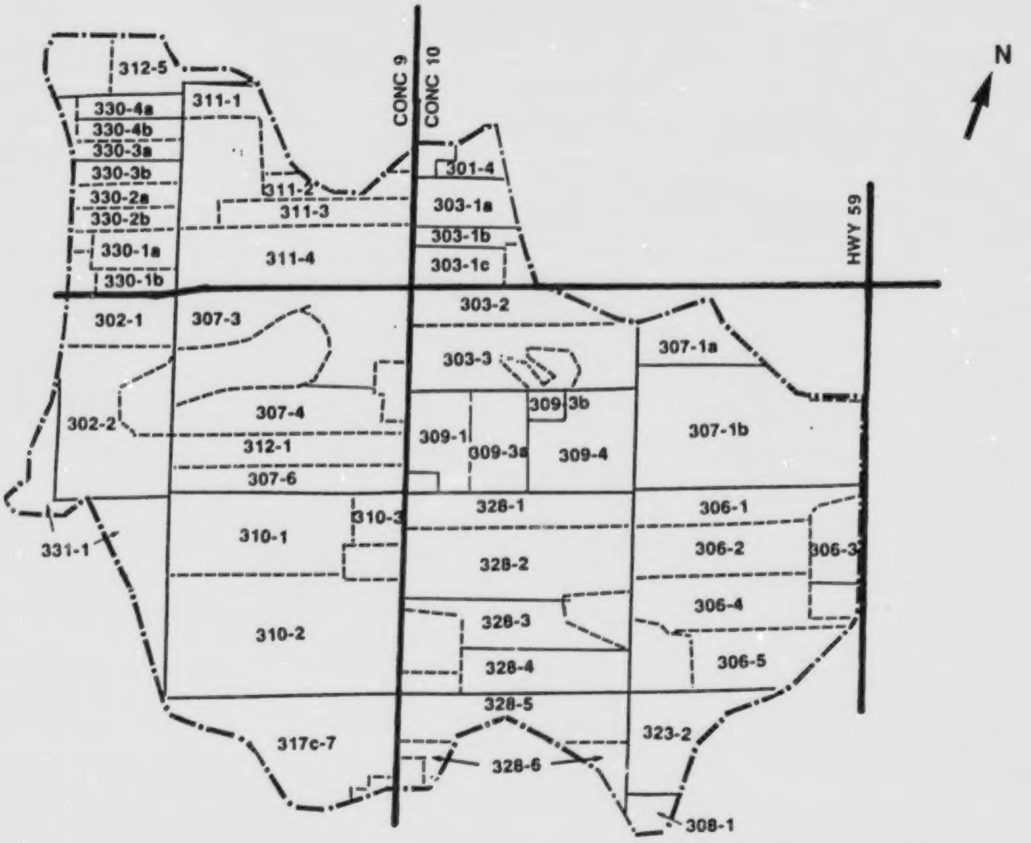
320-4
320-5
315-5
315-4
315-9
315-6
315-7
317-6
319-1a
315-13
314-3a
319-1b
319-1c
315-8a
315-8b
314-3b
316-3
324-1
325-2
317-1
316-2
324-2
316-1
325-3
325-4
317-2
317-21
317-3

PITTOCK TEST SUB-WATERSHED

Field Boundaries (Crop Year 1989-90)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CONC 10
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330-1a
330-1b
311-1
311-2
311-3
311-4
301-4
303-1a
303-1b
303-1c
302-1
307-3
303-2
303-3
307-1a
309-3b
302-2
307-4
312-1
307-6
309-1
309-3a
309-4
307-1b
310-1
310-3
328-1
306-1
331-1
328-2
306-2
306-3
306-4
310-2
328-3
328-4
306-5
328-5
317c-7
323-2
328-6
308-1

PITTOCK CONTROL SUB-WATERSHED

Field Boundaries (Crop Year 1989-90)

AGRONOMIC DATA SPEADSHEET: 1988–1992,
SWEEP PWS

1987–1988 Field Number	1987–1988 # of Acres	1987–1988 Crop	Actual Cover 09/88 Residue (%)	Estimated Cover 09/88 Residue (%)	1988–1989 Field Number	1988–1989 # of Acres	1988–1989 Crop (1–27)	Tillage (Primary) Fall 88
101–1		4						
101–2		4			101–1	35	7	na
101–3		4			101–2	50	4	na
101–4		7			101–3	35	7	na
					101–4	15	4	na
					102–1	5	4	na
103–1	40	20			103–1	40	4	1
103–2	39	20			103–2	39	4	1
103–3	49	4			103–3	49	4	8
104–1a	9	20			104–1a	9	8	1
104–1b	9	20			104–1b	9	3	1
104–2	23	20			104–2	23	4	1
104–3	21	20			104–3	21	22	1
104–4a	34	20			*104–4a	34	3	1
104–4b	34	3			*104–4b	34	3	1
105–11	50	20			105–11	50	3	1
105–12	11	7			105–12	11	4	1
106–1	7	20			106–1	7	4	1
106–2	2	3			106–2	2	4	1
107–4	15	4			107–4	15	7	8
108–1					108–1	5	3	1
108–3					108–4	25	4	1
108–2					108–2	14	4	4
109–1	30	4			109–1	30	10	8
110–1	29	4			110–1	29	7	8
111–1	10	4			111–1	10	4	1
112–17	8	15			112–17	8	15	14
113–1	18	4			113–1	18	3	1
113–2	28	3			113–2	28	4	1
114–1	23	4			114–1	23	4	4
114–2a	7	20			114–2	24	4	4
114–2b	17	20						
114–3	25	4			114–3	25	10	7
115–1	18	20			115–1	18	4	1
115–2	49	3			115–2a	34	4	1
					115–2b	15	4	3
116–1	8	4			116–1	8	7	7
116–2	17	20			116–2	17	4	4
116–3	17	4			116–3	17	7	7
116–4		7			116–4	3	4	7
117–1	9	4			117–1	9	8	7
117–2	3	6			117–2	3	7	6
117–3	16	4			117–3	16	8	6
118–1	27	4			118–1	27	10	8
118–2	9	2			118–2	9	4	8
119–1	2	4			119–1	3	4	1
119–1	1	4						

AGRONOMIC DATA SPEADSHEET: 1988–1992,
SWEEP PWS

1987–1988 Field Number	1987–1988 # of Acres	1987–1988 Crop	Actual Cover 09/88 Residue (%)	Estimated Cover 09/88 Residue (%)	1988–1989 Field Number	1988–1989 # of Acres	1988–1989 Crop (1–27)	Tillage (Primary) Fall 88
121–1a	5	7			121–1c	5	3	3
121–1b	15	7			121–1a	15	3	1
121–2	36	3			121–2	36	4	3
121–3	48	4			121–3	48	3	3
121–4	24	4			121–4	24	4	6
121–5	24	3			121–5	24	4	3
122–1	10	4			122–1	10	8	3
122–2	10	15			122–2	10	15	14
122–2a	6	15			122–2a	6	3	3
122–3	15	11			122–3	15	15	14
122–4	20	15			122–4	20	15	14
122–5	9	3			122–5	9	9	3
123–1	29	3			123–1	29	3	1
124–1a	38	4			124–1a	38	7	7
124–1b	12	4			124–1b	12	7	10
125–1	43	3			125–1	43	3	1
126–1a	12	2			126–1a	16	4	1
126–1b	9	2			126–1b	9	4	3
126–1c	9	2			126–1c	4	4	9
126–2a	3	4			126–2a	4	4	1
126–2b	12				126–2b	12	4	9
126–3	22	18			126–3	22	4	8
126–4	30	4			126–4	30	4	1
127–1	16	3			127–1	16	4	3
127–2a	20	4			127–2a	20	4	9
127–2b	16	4			127–2b	16	10	8
127–2c	16	4			127–2c	16	4	9
127–3	72	4			127–3	72	4	1
127–4	42	4			127–4	42	4	1
127–5	21	20			127–5	21	4	9
201–1	15	15	100		201–1	5	15	14
201–2	16	15	100		201–2	16	1	14
201–3	25	17	100		201–3	25	17	14
201–4	20	17	100		201–4	20	17	14
201–5	20	17	100		201–5	20	17	14
201–6	23	7			201–6	23	10	1
201–7	30	15	100		201–7	30	15	14

AGRONOMIC DATA SPEADSHEET: 1988-1992,
SWEEP PWS

1987-1988 Field Number	1987-1988 # of Acres	1987-1988 Crop	Actual Cover 09/88 Residue (%)	Estimated Cover 09/88 Residue (%)	1988-1989 Field Number	1988-1989 # of Acres	1988-1989 Crop (1-27)	Tillage (Primary) Fall 88
202-1	10	15	100		202-1	10	15	14
203-1	20	2			203-1	20	3	1
203-2	10	20			203-2	10	3	1
203-3	15	15	100		203-3	15	15	14
203-4	25	3			203-4	25	3	1
204-1	45	2	66		204-1	45	4	9
205-1	90	7			205-1	57	7	7
205-1								
205-2	33	4			205-2	66	3	7
206-1	45	4	90		206-1	45	4	9
206-2	45	3			206-2	45	3	5
207-1C	45	4			207-1C	45	10	7
207-2C	30	4			207-2C	30	10	7
208-1	40	20			208-1	40	4	1
208-2	15	3			208-2	15	3	1
216-3C	10	3	84		216-3C	10	4	1
216-4C	10	4			216-4C	10	7	1
216-5C	40	4			216-5C	40	4	6
216-6C	10	3	96		216-6C	5	4	1
216-6C	15	3	96		216-6C	19	3	1
218-11	24	20			218-11	24	3	1
218-12	19	3			218-12	39	4	1
218-14	15	3			218-14	15	10	1
218-21	18	4	97		218-21	23	9	6
218-21bC		4	97					
218-23	20	3	97		218-23	20	4	3
218-4C	5	20			218-4C	5	3	3
218-4C								
218-5C	26	4			218-5C	18	3	9
218-6C	4	3			218-6C	4	3	3
218-7C	16	3	94		218-7C	6	4	3
218-3C	4	20			218-3C	5	3	3
218-3C								
					218-13	30	7	7
207-T1	28	7			207-T1	22	4	10
207-T2	22	7			207-T2	6	4	7
209-1	6	3	90		209-1	6	3	1
209-2	14	3			209-2a	14	3	4
209-2					209-2b	6	3	1
209-3	14	20	88		209-3	14	4	4
209-4	10	4	91		209-4	10	3	9
209-5	24	3	91		209-5	30	3	1
210-1	14	10	100		210-1	14	4	1
210-2	17	4	84		210-2	17	3	1
210-3	26	4	96		210-3	26	2	1
210-4	45	2			210-4	45	2	1

AGRONOMIC DATA SPEADSHEET: 1988–1992,
SWEEP PWS

1987–1988 Field Number	1987–1988 # of Acres	1987–1988 Crop	Actual Cover 09/88 Residue (%)	Estimated Cover 09/88 Residue (%)	1988–1989 Field Number	1988–1989 # of Acres	1988–1989 Crop (1–27)	Tillage (Primary) Fall 88
210–5	30	3	78		210–5	30	4	1
210–6								
212–1					212–1	7	7	7
212–2					212–2	25	9	6
212–3					212–3	11	7	1
213–7					213–7	6	15	14
213–1	8	17	100		213–1	8	17	14
213–4	5	3			213–4	5	4	1
213–5	4	3			213–5	4	3	1
					214–1	18	3	1
215–1	14	3	96		215–1	14	4	1
215–2	14	7			215–2	14	10	7
216–11	13	4			216–11	13	4	6
216–12	15	3	94		216–12	15	3	1
216–1a	15	11			216–1T	25	4	6
216–1b	10	20						
216–2T	15	3			216–2T	15	4	1
216–2T								
216–3T	10	3	96		216–3T	10	4	1
216–4T	3	4			216–4T	3	7	10
216–5T	6	4			216–5T	6	4	6
							4	
216–6T	10	3	96		216–6T	10	4	1
216–6T	5	3	96		216–6T	5	3	1
217–1	35	18			217–1	35	2	8
217–2	40	15	100		217–2	40	15	14
217–3	10	17	100		217–3	10	17	14
218–1T	10	3	96		218–1T	10	3	3
218–23	8	3	97		218–23	8	4	3
218–24	10	9			218–24	10	10	5
218–25	7	3	95		218–25	7	23	9
218–25T					218–25T			
218–26	12	9			218–26	12	10	5
218–27	18	20			218–27	18	3	1
218–2T	16	3	97		218–2T	16	4	3
218–3T	36	3	95		218–3T	36	3	3
218–3T								
218–4a	5	20	100		218–4T	5	3	3
218–4b	5	20	100		218–4T	5	3	9
218–5T	5	4	97		218–5T	5	3	3
218–6T	2	3	96					
218–7T	2	3		96	218–7T	2	3	3
					218–13	6	7	7
219–1	10	3	92		219–1	10	4	3
219–2	9	3	90		219–2	9	4	3
219–3	16	4	94		219–3	16	3	9
219–4	4	3	88		219–4	4	4	3
219–5	2	4	96		219–5	2	4	9
220–1	8	7			220–1	8	10	8
220–2	8	4	96		220–2	8	4	9
220–3a	12	10	100		220–3a	12	8	9
220–3b	10	4	96		220–3b	10	23	9
					220–5	10	17	14
					220–4	13	15	14

AGRONOMIC DATA SPEADSHEET: 1988−1992, SWEEP PWS

1987−1988 Field Number	1987−1988 # of Acres	1987−1988 Crop	Actual Cover 09/88 Residue (%)	Estimated Cover 09/88 Residue (%)	1988−1989 Field Number	1988−1989 # of Acres	1988−1989 Crop (1−27)	Tillage (Primary) Fall 88
221−1	17	3	96		221−1	17	4	3
221−2	13	4	98		221−2	13	3	3
221−3a	1	3	96		221−3	5	11	9
221−3b	1	3	96		221−4−	4	11	3
221−4−	7	4	98					
222−1					222−1	5	3	na
222−2					222−2	9	3	na
222−2								
301−4	5	3	70		301−4	5	3	3
302−1	15	3	61		302−1	15	5	9
302−2	9	3	66		302−2	31	3	1
302−3	7	3						
302−4	15	3						
303−1	25	3	71		303−1	25	24	1
303−2	12	3	73		303−2	12	24	1
303−3	35	4	22		303−3	35	3	9
					306−1	18	15	14
306−2	20	3	68		306−2	20	3	9
306−3	6	15	84		306−3	6	15	14
306−4	21	15	86		306−4	21	15	14
306−5	19	3	67		306−5	19	3	9
307−1	66	3	69		307−1	66	3	9
					307−3	35	15	14
307−4	11	3	64		307−4	11	3	3
307−5	20	15	93		307−5*	20	15	14
					307−5*	20	29	1
307−6	15	3	78		307−6	15	3	3
308−1	5	15	70		308−1	5	25	1
309−1	7	25	56		309−1	11	26	1
309−2	4	12	56					
309−3	22	3	72		309−3	22	3	1
309−4	16	3	88		309−4	16	15	1
310−1	32	3	75		310−1	32	3	9
310−2	60	3	78		310−2	60	3	9
310−3	6	3	76		310−3	6	3	9
311−1a	6	3	79		311−1	12	27	1
311−1b	6	3	79					
311−2	5	3	82		311−2	5	27	9
311−3	12	3	69		311−3	12	27	1
311−4	24	3	72		311−4	24	4	9
312−5	9	3	75		312−5	9	25	9

AGRONOMIC DATA SPEADSHEET: 1988–1992,
SWEEP PWS

1987–1988 Field Number	1987–1988 # of Acres	1987–1988 Crop	Actual Cover 09/88 Residue (%)	Estimated Cover 09/88 Residue (%)	1988–1989 Field Number	1988–1989 # of Acres	1988–1989 Crop (1–27)	Tillage (Primary) Fall 88
317c–7	17	3	72		317C–7	17	3	1
323–2	20 ?				323–2	20	3	9
					330–4a	6	16	na
					330–4b	6	1	na
					330–3a	8	25	na
					330–3b	4	3	na
					330–2a	6	3	na
					330–2b	6	16	na
					330–1a	8	1	na
					330–1b	4	15	na
					328–1	14.8	na	na
					328–2	36.6	15	na
					328–5	21.5	na	na
					328–6	7.9	na	na
304–1	32	3	78		304–1	10	3	9
304–2		3			304–2	12	3	9
304–3		15			304–3	10	3	9
					313–2	5.4	17	14
313–1a	5	3	76		313–1	11	3	1
313–1b	6	3	76					
314–1	14	9	60		314–1	14	12	4
314–2	14	12	92		314–2	14	15	14
314–3	17	3	76		314–3	17	3	2
315–1	20	7	16		315–1	20	10	4
315–13	4	15	92		315–13	4	15	14
315–2	20	3	61		315–2	20	9	1
315–3	8	3	72		315–3	8	9	9
315–4	30	20	92		315–4	30	3	3
315–5	10	7	16		315–5	10	10	1
315–6	14	15	90		315–6	14	3	1
315–7	7	15	92		315–7	7	15	14
315–8a	10	3	68		315–8a	25	3	3
315–8b	25	3	68		315–8b	10	3	9
315–9	5	12	16		315–9	5	7	4
316–1	12	3	18		316–1	12	3	3
316–2	16	20	90		316–2	16	3	3
316–3	15	7	68		316–3	15	10	1
317–1	48	3	77		317–1	48	24	3
317–2	5	3,1	26		317–2	5	3	9
317–21	7	7	16		317–21	7	7	4
317–3	4	15	24		317–3	4	24	1
317–6	25	3	74		317–6	25	5	3
318–1	18	26	78		318–1	18	15	14
318–2a	10	8	85		318–2a	10	4	4

AGRONOMIC DATA SPEADSHEET: 1988−1992, SWEEP PWS

1987−1988 Field Number	1987−1988 # of Acres	1987−1988 Crop	Actual Cover 09/88 Residue (%)	Estimated Cover 09/88 Residue (%)	1988−1989 Field Number	1988−1989 # of Acres	1988−1989 Crop (1−27)	Tillage (Primary) Fall 88
318−2b	8	3	85		318−2b	8	25	2
318−2c	7	3	85		318−2c	7	26	1
318−3a	5	3	72		318−3a	1	3	2
					318−3b	1.5	4	9
					318−3c	2.5	25	9
					318−4	9	15	14
318−4	9	15	88					
318−5	9	16	92		318−5	9	1	1
319−1	50	3	64		319−1	50	3	1
320−1	28	8	38		320−1a	17	1	3
					320−1b	6	1	9
320−2a	8.5	1	25		320−2a	10	25	1
320−2b	8.5	1	25		320−2b	7	1	1
320−3	12	26	24		320−3	8	15	1
320−4	11	15	92		320−4	20	15	14
320−5a	6	1	25		320−5a	5	26	2
320−5b	5	1	25		320−5b	6	26	9
320−6	6	17	84		320−6	6	25	1
					320−7	3	17	14
322−1	15	26	86		322−1	15	15	14
322−2	7	1	18		322−2	7	3	4
322−6	4	3	8		322−6	4	3	9
323−1		3			323−1	4	3	9
325−2	8	3	72		325−2	8	24	1
325−3	12	4	24		325−3	12	3	1
325−4	5	15	94		325−4	5	15	14
326−31	21	3	71		326−31	21	4	3
326−32	46	3	69		326−32	28	4	3
326−33	19	3			326−33	19	24	3
326−34	22	3	72		326−34	22	5	3
326−41	17	3	73		326−41	27	24	3
326−42	10	3	73					
326−43	5	15	91		326−43	5	15	14
326−44	5	3	67		326−44	5	3	3
324−1					324−1	19	16	14
324−2					324−2	3.5	16	14

1988-1989 Field Number	Secondary Tillage 1988-89										Actual Cover 10/88 %	Est Cover 10/88 %	Actual Cover 04/89 %	Est Cover 04/89 %
101-1													64.2	
101-2													71.8	
101-3													68.5	
101-4													4	
102-1														
103-1	7	7	7\2\3								9		5.1	
103-2	7	7\2\3		7							9		5.1	
103-3	7\3		7\3	7\3	7						58		36	
104-1a	7	7									10		5.2	
104-1b	7	7											3.8	
104-2	1	7	5	3	2	11	7	7	3		3		4	
104-3	1	7	5	3	2	11	7	7	3		8			5
*104-4a	11	11	1	7/3/2		7/3/2					11.5		3.8	
*104-4b	11	11	1	7/3/2		7/3/2							10.9	
105-11	1	13	11								17		10.4	
105-12	1	13	11								23		16.7	
106-1	1\3	7\3	7\3	6\3	4								6.3	
106-2	1\3	7\3	7\3	6\3	4						15		4	
107-4	6										59		60.7	
108-1	1	11	6\2\3		6								8.8	
108-4	1	11	6										10.8	
108-2	1	11	6										8.8	
109-1	7										42		31.8	
110-1	1										42		29.8	
111-1	7/3/2										3		2.7	
112-17	none										100		93.7	
113-1	7	7\2\3		7\2\3		4					9		6.3	
113-2	1\2\3												6.8	
114-1	7\2\3		7\2\3		4	7		7\2\3	7\3	4	38		16	
114-2	7	3	7\2\3								73		45.3	
114-3	7\3	4									54		35	
115-1	7	11	7	7\3	7\3						6		19	
115-2a	7	7\3	7\3								41		14.6	
115-2b	7	7\3	7\3											
116-1											57		53.2	
116-2	7	7									37		27	
116-3											61		49.2	
116-4													46.6	
117-1	7										25		22.5	
117-2	7	7									15		75.5	
117-3	7	7									30		17.6	
118-1	7										41		36	
118-2	7										23		11	
119-1	1	7\3\2									10		13	

1988–1989 Field Number	Secondary Tillage 1988–89									Actual Cover 10/88 %	Est Cover 10/88 %	Actual Cover 04/89 %	Est Cover 04/89 %
121–1c	1	7\2	7\2\3		7\2\3		4	4		21		27	
121–1a	7\2	7\3\2		7\3\2		7\3\2		4	4	14		19	
121–2	1	7\2	7\3	7\3						15		18.3	
121–3	7\2	4								17		8.5	
121–4	7\2	4								28		19.4	
121–5	7\2	7	7\3							20		13.7	
122–1	7									3.2		9.3	
122–2										100		92	
122–2a	1	11	6	7\3\2\8		7\3\2\8				14		10	
122–3										50		87	
122–4										100		88	
122–5	7									15		10	
123–1	1/2/3		1/2/3		6/3/2					25		10	
124–1a										42		45	
124–1b										68		56.8	
125–1	6/3/2		6/3/2		6/3/2		12			1		6.5	
126–1a	1	2	3	1								6.4	
126–1b										18.5		14	
126–1c										18.5		43.6	
126–2a	1									14		2.5	
126–2b												70.8	
126–3	1									100		74.3	
126–4	1	1/2/3		1	1					2.4		3	
127–1	1	7/3								15		12.4	
127–2a										91		79.6	
127–2b	1	7/3								22		87.6	
127–2c										92.5		38	
127–3	1									3		5.8	
127–4	1	7/3								2.4		6.4	
127–5	1	7/3								100		79.7	
201–1										100			70
201–2	10	6	6	6	5					100			95
201–3										100			70
201–4										100			70
201–5										100			70
201–6	7	7											5
201–7										100			70

1988–1989 Field Number	Secondary Tillage 1988–89							Actual Cover 10/88 %	Est Cover 10/88 %	Actual Cover 04/89 %	Est Cover 04/89 %
202–1								100			70
203–1	6	6	2/3	6	4			7		6.8	
203–2	6	6	2/3	6	4			5		6.5	
203–3	6/2/3							100			70
203–4	6	6	2/3	6	4	6		4.5		8.4	
204–1	10	1	6					66		50.3	
205–1											49.1
205–2	7	7						32		62.3	
206–1	6	6						90		70	
206–2	13	6	6					50		48.3	
207–1C											35
207–2C	7										35
208–1	5	5	5	5				8		10.8	
208–2	7	7	7					6		12.5	
216–3C	6	6	6	7	4			8		7.5	
216–4C											35
216–5C	1	7	7	6	6	6	7	22			5
216–6C	6	6	6	7	5			7			
216–6C	6	6	6	7	5			7			
218–11	1	1	1	6	2/3			5		11.6	
218–12	6	7						6		6.5	
218–14											5
218–21	7	7						67.5		56	
218–23								17			
218–4C										9.2	
218–5C	10									93.3	
218–6C	7	6								7.5	
218–7C	6							15		6.7	
218–3C								4		10	
218–13											
207–T1										83	
207–T2	10	7	7								
209–1	7	7						6		9.3	
209–2a	7	7	7					6			
209–2b	7	7	7							10.7	
209–3	7	7	7					45		48.5	
209–4	7	7	7					88		89	
209–5								6		8.6	
210–1	7	7						8		10	
210–2	7	7						5		5.6	
210–3	7	7	7					5		3.3	
210–4	7	7	7					5		6.4	

1988–1989 Field Number	Secondary Tillage 1988–89						Actual Cover 10/88 %	Est Cover 10/88 %	Actual Cover 04/89 %	Est Cover 04/89 %
210–5	7	7					4.5		4.9	
212–1	6									
212–2	6	6								
212–3										
213–7										
213–1							100			70
213–4	7	7	7	9			8		6	
213–5							8		3.3	
214–1										
215–1							7		9.3	
215–2										70
216–11	6	6	6	7			22		31	
216–12	5	6	6	6	7		7		4.8	
216–1T	6	6	6	7	4		82		58.3	
216–2T	6	6	6	7					7.2	
216–3T							7		9.3	
216–4T										70
216–5T	6	6	6	7			14		36.3	
216–6T	6	6	7				7		8.3	
216–6T	6	6	7				7		8.3	
217–1	10	6	6	6			82		93.7	
217–2							100			70
217–3							100			70
218–1T	6	6	5				12		10	
218–23	6	6	7	7			17		12.8	
218–24										70
218–25							95			70
218–25										
218–26										70
218–27	1	1	1	6	5		5		6.5	
218–2T	6	7					14		13	
218–3T	6	5					14		10	
218–4T							16			
218–4T								100		
218–5T	6	6	5				97			
218–7T								14		
218–13										
219–1	6	7	3				12		12.7	
219–2	1	6	6	3			12		11.3	
219–3	6	6	5				94		92.5	
219–4	6	6	7	3			12		6	
219–5	7						96		81.3	
220–1										
220–2	1	6	6	6	5	5	96		88.7	
220–3a	1	6	6						82.4	
220–3b	1	6					96			70
220–5										
220–4										

1988–1989 Field Number	Secondary Tillage 1988–89						Actual Cover 10/88 %	Est Cover 10/88 %	Actual Cover 04/89 %	Est Cover 04/89 %
221–1	1	1	7	5			20		15	
221–2	1	7	7	2	5				18	
221–3	1	7	2				96		86.7	
221–4–	1	7	2							
222–1										
222–2										
301–4	6	6								
302–1	6	6							12	
302–2	6	6							9.7	
303–1	1	6	6	3/2	5		6		19.7	
303–2	1	6	6	3/2	5		4		17	
303–3	6	6	6	2					61.8	
306–1										
306–2	10	1	6	3/2	2				84	
306–3										70
306–4	10	1	6	3/2	2					70
306–5	10	1	6	3/2	2				81.6	
307–1	1	6	3						79.8	
307–3										
307–4	1	6	3						8.5	
307–5*										70
307–5*										
307–6	1	6							8	
308–1	6	6	6	2	2				12	
309–1	6	6	2	3					0.7	
309–3	6	1/2	3/2	5					10	
309–4							1		10	
310–1	1	2	2	2					73	
310–2	1	1	2	2					75.8	
310–3	1								80	
311–1	1	6	3	5	5				8	
311–2	1	6	3	5	5				80	
311–3	6	6	3	5	5				10	
311–4	1	6	6	6	3				88	
312–5	1	1	2	1	2	3			96.7	

1988–1989 Field Number	Secondary Tillage 1988–89						Actual Cover 10/88 %	Est Cover 10/88 %	Actual Cover 04/89 %	Est Cover 04/89 %
317C–7	6	6							15.6	
323–2	1	1	6						79.5	
330–4a										na
330–4b										na
330–3a										na
330–3b										na
330–2a										na
330–2b										na
330–1a										na
330–1b										na
328–1										
328–2										
328–5										
328–6										
304–1	10	1	6						76.7	
304–2									83.5	
304–3										
313–2										
313–1	7	7					6		15.2	
314–1	4	3					20		7.5	
314–2									69	
314–3	4	6					6		10	
315–1	7								40.8	
315–13										70
315–2	7	7	3				2		6.4	
315–3	10	7	7	3					71.3	
315–4	7	7	1	3			5		6.2	
315–5	1	7							14.7	
315–6	1	1	1	3	3	5				5
315–7										70
315–8a	1	1	1	3	3	5	5		6.7	
315–8b	1	1	1	3	3	5			88.8	
315–9									16	
316–1	6	6	1	2					14	
316–2	6	6	1	2	5		6		6	
316–3	6	6					7		14	
317–1	6	6	6	6			6		12.5	
317–2	10	6	6	3/2	5				63.3	
317–21							8		40.7	
317–3	6	6	6	5					26.7	
317–6	6	6	6						8.4	
318–1	3									70
318–2a	6	6	3				31		72	

1988–1989 Field Number	Secondary Tillage 1988–89							Actual Cover 10/88 %	Est Cover 10/88 %	Actual Cover 04/89 %	Est Cover 04/89 %
318–2b	6	6	3	3						7.6	
318–2c	6	6	3								5
318–3a	1	11	3	6	3			7		16.7	
318–3b	1	6	6	2							
318–3c											
318–4	3										70
318–5	1	1	3	6	3	3	3				5
319–1	6	6	3/2					2		5.4	
320–1a	1	2	6	3				0		4.7	
320–1b											
320–2a	6							0			5
320–2b	6							0			5
320–3	1	6	1	3				0			5
320–4											70
320–5a	1	6	2							6.7	
320–5b	6	2						0		21.3	
320–6	6	3						0		3.3	
320–7											70
322–1											70
322–2	6	6	5					3		11.3	
322–6										44	
323–1	1	1	6								
325–2	6	2	4	5				2		10	
325–3	6	2	4	5				0		5.5	
325–4											70
326–31	6	6						4		9.3	
326–32	6	6						4		10.8	
326–33	6	6	5					5		10.8	
326–34	6	6	5					5		10.8	
326–41	6	6	6	5				5		14	
326–43	10	1	1	6	6	5					70
326–44	6	6						6		23.3	
324–1											70
324–2											70

1988–1989 Field Number	Actual Cover 06/89 %	Est Cover 06/89 %	Actual Harvest 09/89 %	Est Harvest 09/89 %	Actual Cover 10/89 %	Est Cover 10/89 %	Yield 1989	Units	Source	# Sa
101–1							na			
101–2							na			
101–3							na			
101–4							na			
102–1							na			
103–1	8.8			70			43.9	bu/ac	ww	2
103–2	6.8			70			44.5	bu/ac	ww	2
103–3	20.5			70			42.5	bu/ac	ww	2
104–1a		45		70			na			
104–1b	10.8						na			
104–2	2.8			70			45	bu/ac	elev	
104–3		5		70			2780	lb/ac	elev	
*104–4a	10.8			70	18		160	bu/ac	elev	
*104–4b	10.8			70	18		160	bu/ac	elev	
105–11	15.8			70			3.85	ton/ac	est	
105–12	12			70			50	bu/ac	elev	
106–1	2.7		89.7				45.9	bu/ac	ww	2
106–2	5.3			70			45.9	bu/ac	ww	2
107–4		45		70	22		64	bu/ac	ww	2
108–1				70			na			
108–4				70			na			
108–2				70			na			
109–1		45		70			59	bu/ac	ww	1
110–1		45		70			53	bu/ac	ww	2
111–1	5.3		90		7.8		40	bu/ac	ele	
112–17		70		70			na			
113–1	3.5			70			106	bu/ac	ww	12
113–2	19			70			945	lb/ac	elev	
114–1	9.6			70			38.5	bu/ac	ww	2
114–2	42.8		97.3		45.7		43.6	bu/ac	ww	2
114–3		45		70	23		56	bu/ac	ww	2
115–1	12		86.3				33	bu/ac	est	
115–2a	14		55.5				na	bu/ac	est	
115–2b			55.5				na	bu/ac	est	
116–1	24.7			70	38.6		71	bu/ac	ww	1
116–2	24.5			70			47.1	bu/ac	ww	2
116–3	24.7			70	37.2		75	bu/ac	ww	1
116–4			89.3				na			
117–1		45		70	26		62	bu/ac	ele	
117–2		45		70			76	bu/ac	ww	1
117–3		45		70			54	bu/ac	ww	1
118–1		45		70	41.9		70	bu/ac	ww	1
118–2	9		87.3	70	43.6		44.2	bu/ac	ww	4
119–1	3.3			70			47.7	bu/ac	ww	2

1988–1989 Field Number	Actual Cover 06/89 %	Est Cover 06/89 %	Actual Harvest 09/89 %	Est Harvest 09/89 %	Actual Cover 10/89 %	Est Cover 10/89 %	Yield 1989	Units	Source	# Sa
121–1c	6.75			70			119.7	bu/ac	ww	1
121–1a		25		70			130.3	bu/ac	ww	2
121–2	7.5			70			34.1	bu/ac	ww	3
121–3	5			70			104	bu/ac	elev	
121–4	18.4			70			26.6	bu/ac	ww	1
121–5	6		56.7				33.8	bu/ac	ww	2
122–1		45		70			18	bu/ac	est	
122–2		70		70			170	bales/ac		
122–2a	10.6			70			130	bu/ac	est	
122–3		70		70			160	bales/ac		
122–4		70		70	5.5		75	bales/ac		
122–5		45		70			55	bu/ac	est	
123–1	8.7			70			116.8	bu/ac	elev	
124–1a		45		70	12.4		116.8	bu/ac	elev	
124–1b		70		70	32		62.5	bu/ac	ww	2
125–1	2			70	11.2		135.9	bu/ac	ww	2
126–1a		5		70	4		16.4	bu/ac	est	
126–1b		5		70	4		16.4	bu/ac	est	
126–1c	4			70			16.4	bu/ac	est	
126–2a		5		70			16.4	bu/ac	est	
126–2b	14			70			16.4	bu/ac	est	
126–3	15.6			70			16.4	bu/ac	est	
126–4	1.3			70			80	lb/ac	est	
127–1	12			70	45.6		49.5	bu/ac	ww	2
127–2a	9.6			70	8.8		39.6	bu/ac	ww	1
127–2b				70	7.6		71	bu/ac	ww	2
127–2c	13.3			70	22.8		45	bu/ac	ww	2
127–3	1.5		85.8				42.4	bu/ac	ww	2
127–4	1			70			42	bu/ac	ww	2
127–5	7		98.4				48.8	bu/ac	ww	1
201–1		70		70		70	na			
201–2		5	27			5	na			
201–3		70		70		70	na			
201–4		70		70		70	na			
201–5		70		70		70	na			
201–6		45		70		70	65	bu/ac	ww	2
201–7		70		70		70	na			

1988–1989 Field Number	Actual Cover 06/89 %	Est Cover 06/89 %	Actual Harvest 09/89 %	Est Harvest 09/89 %	Actual Cover 10/89 %	Est Cover 10/89 %	Yield 1989	Units	Source	# Sa
202–1		70		70		70	na			
203–1	6.8		92.4			5	129	bu/ac	est	
203–2	2.7			70		45	129	bu/ac	est	
203–3		70		70		70	na			
203–4	9.3			70	14		na			
204–1		5	72.8			5	na			
205–1		45		70		5	75	bu/ac	est	
205–2	20.5		94			5	105	bu/ac	ww	2
206–1	11.6			70		5	33	bu/ac	est	
206–2	30.7			70		5	na			
207–1C		45		70	4		65	bu/ac	est	
207–2C		45		70		5	65	bu/ac	est	
208–1	7.8			70	12		43	bu/ac	elev	
208–2	8			70		5	140.5	bu/ac	elev	
216–3C	12.7		79			25	35.6	bu/ac	elev	
216–4C		45		70		5	63.4	bu/ac	elev	
216–5C	12.3		85			25	40.5	bu/ac	elev	
216–6C		5		70		5	40.5	bu/ac	elev	
216–6C		5		70		5	143.19	bu/ac	elev	
218–11	18.9		95.3		7		103	bu/ac	elev	
218–12	5.5			70	6.6		30	bu/ac	est	
218–14		45		70			80	bu/ac	est	
218–21		45		70	59.5		59	bu/ac	ww	2
218–23		15	96			45	40	bu/ac	est	
218–4C		5		70		45	128	bu/ac	ww	
218–5C		5		70		15	112	bu/ac	ww	
218–6C		5	98			15	140	bu/ac	est	
218–7C		5		70	59		na			
218–3C				70			na			
218–13							na			
207–T1	58.7		95			5	32	bu/ac	est	
207–T2	4		93			5	38	bu/ac	est	
209–1	18		94.7			5	130	bu/ac	est	
209–2a	28			70		5	na	bu/ac	est	
209–2b							na			
209–3	21			70		70	52	bu/ac	est	
209–4	8.8		95		54.5		112	bu/ac	est	
209–5	8.8			70		5	101.4	bu/ac	ww	3
210–1	7			70	12		35	bu/ac	elev	
210–2	4			70		5	115	bu/ac	est	
210–3	2.6		71.4			5	7	ton/ac	est	
210–4	5.3				65	5	6.5	ton/ac	est	

1988–1989 Field Number	Actual Cover 06/89 %	Est Cover 06/89 %	Actual Harvest 09/89 %	Est Harvest 09/89 %	Actual Cover 10/89 %	Est Cover 10/89 %	Yield 1989	Units	Source	# Sa
210–5	5.4		90.6			25	34.5	bu/ac	elev	
212–1							54	bu/ac	ele	
212–2							47	bu/ac	ele	
212–3							54	bu/ac	ele	
213–7							na			
213–1		70		70		70	153	bales/ac		
213–4	20.7		88.5			25	35	bu/ac	est	
213–5	7.3			70		45	na			
214–1							na			
215–1	7.5			70		45	29	bu/ac	est	
215–2		70		70		45	63	bu/ac	ele	
216–11	9		75.5		58.5		30	bu/ac	est	
216–12	6.5		92		14.5		121.4	bu/ac	ele	
216–1T	22.3		89.3		27.7		38.5	bu/ac	ww	2
216–2T	8			70		25	42.8	bu/ac	ww	2
216–3T	12.7		79			45	na			
216–4T		70		70		5	64.8	bu/ac	elev	
216–5T	12.3		85			70	40.5	bu/ac	ele	
216–6T	10.8			70		5	40.5	bu/ac	elev	
216–6T	10.8			70		5	143.19	bu/ac	elev	
217–1		5		70	6		na			
217–2		70		70	4.8		na			
217–3		70		70		70	na			
218–1T	12		98		16		131	bu/ac	ww	2
218–23		5	96			45	40	bu/ac	est	
218–24		70		70	8.5		44	bu/ac	ww	3
218–25		70		70	19		na			
218–25										
218–26		70	91			15	55	bu/ac	est	
218–27	9.6		93			15	135.5	bu/ac	ww	4
218–2T	14		94.4			65	46.2	bu/ac	ww	1
218–3T	9.7		94.3			15	142.1	bu/ac	ww	1
218–4T				70		45	128	bu/ac	ww	2
218–4T	58.7			70		45	87.3	bu/ac	ww	3
218–5T	30		98.4			15	112	bu/ac	ww	1
218–7T	2			70	59.3		140	bu/ac	est	
218–13							na			
219–1	14			70	64.7		na			
219–2	15.3		89		66		34.78	bu/ac	est	
219–3	26.8			70		15	104.2	bu/ac	elev	1
219–4	13.3		90		72		34.78	bu/ac	est	
219–5	30		73.3				34.78	bu/ac	est	
220–1		70		70		45	139	bu/ac	elev	
220–2	12.7			70		45	18.75	bu/ac	est	
220–3a		70		70	59		42.1	bu/ac	elev	
220–3b		5		5	3		na			
220–5										
220–4										

1988–1989 Field Number	Actual Cover 06/89 %	Est Cover 06/89 %	Actual Harvest 09/89 %	Est Harvest 09/89 %	Actual Cover 10/89 %	Est Cover 10/89 %	Yield 1989	Units	Source	# Sa
221–1	14.8			70		65	36	bu/ac	est	
221–2	26.5			70		45	120	bu/ac	est	
221–3		70		70		45	na	bu/ac	est	
221–4–							na	bu/ac	est	
222–1							na			
222–2							na			
301–4	6				89.4	5	140	bu/ac	elev	
302–1	5.7		49			25	1700	lb/ac	elev	
302–2	9.8		98			5	112.5	bu/ac	elev	
303–1	9.3		55.6			48	2643	lb/ac	elev	
303–2	9.3		62.5		48		2157	lb/ac	elev	
303–3	9.3		97		3		134	bu/ac	elev	
306–1							na			
306–2	7.3		96.7			15	cob meal			
306–3		5	73.3			15	cob meal			
306–4		70	90			75	115	bu/ac	ww	1
306–5			92.4			45	118	bu/ac	ww	5
307–1	6.8			70		45	na			
307–3							na			
307–4	3.3		93			5	125	bu/ac	est	
307–5*						75	na			
307–5*							100	lb/ac	est	
307–6	4.3		93.5			5	125	bu/ac	est	
308–1		70	88			5	70	bu/ac	est	
309–1		70	94			45	65	bu/ac	ww	
309–3	2.3		91.1		5		120	bu/ac	est	
309–4				70	62	5	na			
310–1	9.3		95			45	141.5	bu/ac	ww	6
310–2	9.3		97.8			45	150	bu/ac	est	
310–3	4.8		93			45	159	bu/ac	ww	1
311–1	3.3		94			45	120	bu/ac	est	
311–2	3.3		90.7			45	130	bu/ac	est	
311–3		5	94			45	130	bu/ac	est	
311–4	5.8		96			5	3526.4	kg/ha	ww	
312–5		70	92		12		81	bu/ac	ww	

1988–1989 Field Number	Actual Cover 06/89 %	Est Cover 06/89 %	Actual Harvest 09/89 %	Est Harvest 09/89 %	Actual Cover 10/89 %	Est Cover 10/89 %	Yield 1989	Units	Source	# Sa
317C–7	11			70		45	140	bu/ac	elev	
323–2	3			70		5	137.5	bu/ac	elev	
330–4a		na		70			na			
330–4b		na		70			na			
330–3a		na		70			na			
330–3b		na		70			na			
330–2a		na		70			na			
330–2b		na		70			na			
330–1a		na		70			na			
330–1b		na		70			na			
328–1							na			
328–2							na			
328–5							na			
328–6							na			
304–1		5	96			5	na			
304–2			96				na			
304–3			98				na			
313–2							na			
313–1	9.8		99		13		131	bu/ac	ww	2
314–1		70		70		45	na			
314–2		70		70		75	na			
314–3	13.3		90.4			15	132	bu/ac	ww	2
315–1		70	100			15	86.5	bu/ac	ww	2
315–13		70		70		75	82	bu/ac	est	
315–2		70		70	44		82	bu/ac	ww	1
315–3		70		70	38		82	bu/ac	est	
315–4	4.5		96.6		18		163	bu/ac	ww	1
315–5		70	50		82.7		3200	lb/ac	est	
315–6		5	91			45	133	bu/ac	ww	1
315–7		70				70	na			
315–8a	8.8		95.4			45	na	bu/ac	ww	1
315–8b			95.4			45	na			
315–9		70		70		45	na			
316–1	3		91		20		125	bu/ac	elev	
316–2		5	94.4		18		122	bu/ac	elev	
316–3		70	95		16		76	bu/ac	ww	1
317–1	9.5		87		87		2500	lb/ac	elev	
317–2		5		70		15	145	bu/ac	elev	
317–21		70	98			15	70	bu/ac	elev	
317–3		5	90		90		2500	lb/ac	elev	
317–6	6			70	7		2700	lb/ac	elev	
318–1		70		70		70	153	bales/ac		
318–2a		70	92		92		2233	lb/ac	est	

1988–1989 Field Number	Actual Cover 06/89 %	Est Cover 06/89 %	Actual Harvest 09/89 %	Est Harvest 09/89 %	Actual Cover 10/89 %	Est Cover 10/89 %	Yield 1989	Units	Source	# Sa
318–2b			92		71	45	58	bu/ac	est	
318–2c		5	94		94		58	bu/ac	est	
318–3a	11		94		94		na			
318–3b	10			70			58	bu/ac	est	
318–3c				70			58	bu/ac	est	
318–4		70		70		75	na			
318–5	3.7		28			5	3200	lb/ac	est	
319–1		5		70			na			
320–1a	4.8		30.8		5.6		na	bu/ac	ww	
320–1b							na			
320–2a		5	95				67	bu/ac	ww	1
320–2b		5	34		34		67	bu/ac	ww	1
320–3		70		70	13		107	bales/ac		
320–4		70		70		70	na			
320–5a		70		70		45	na			
320–5b		70		70		45	na			
320–6		70	94			5	67	bu/ac	ww	1
320–7		70		70			na			
322–1		70		70		75	na			
322–2	10.5		94.7		9		112	bu/ac	ww	4
322–6		5		70		5	120	bu/ac	est	
323–1	2.8			70			137.5	bu/ac	elev	
325–2	2			70	65		2400	lb/ac	elev	
325–3	2.4			70		45	150	bu/ac	est	
325–4		70	97		97		100	bales/ac		
326–31		4.8		70	82		39	bu/ac	elev	
326–32	4.9			70	79		39	bu/ac	elev	
326–33	4.9			70	79		2950	lb/ac	elev	
326–34	4.9			70	43		2620	lb/ac	elev	
326–41	8.8			70	32		2950	lb/ac	elev	
326–43		70		70	49		2520	lb/ac	elev	
326–44		15	98		16		130	bu/ac	elev	
324–1		70		70			na			
324–2		70		70			na			

1988–1989 Field Number	ples	Other Comments	1989–1990 Field Number	1989–1990 Field Acres	Crop 1989–1990 (1–27)	Tillage (Primary) Fall 89
101–1			101–1	35	4	1
101–2			101–2	50	7	1
101–3			101–3	35	4	1
101–4			101–4	15	7	1
102–1			102–1	5	7	1
103–1	2 diff var		103–1	40	4	1
103–2			103–2	39	4	1
103–3			103–3	49	7	7
104–1a			*128–1a	9	3	1
104–1b			*128–1b	9	3	1
104–2			104–2	44	7	7
104–3						
*104–4a	4 dif var		104–5	18	4	1
*104–4b	4 dif. var.		104–4	50	28	1
105–11			105–11	50	4	1
105–12			105–12	11	2	6
106–1			106–1	7	4	9
106–2			106–2	2	7	7
107–4			107–4	15	4	1
108–1			108–1	5	4	1
108–4			108–3	5	2	1
108–2			108–2	9	4	1
			108–4	25	2	1
109–1			109–1	30	3	1
110–1			110–1	29	4	1
111–1			111–1	10	3	1
112–17	alfalfa		112–17	8	15	14
113–1	9 diff var		113–1	18	4	1
113–2			113–2	28	3	1
			test			
			114–1	24	7	7
114–1			*114–4a	4	4	9
114–2			*114–4b	4	4	9
			114–2	17	4	6
			114–3	23	4	6
114–3			115–1	18	4	1
115–1			*115–2a	34	6	1
115–2a	28 bu/ac – not clear if 2a or 2b		*115–2b	15	6	1
115–2b			116–1	8	4	7
116–1			116–2	17	7	7
116–2			116–3	17	4	7
116–3			116–4	3	7	7
116–4			117–2	3	4	5
117–1			117–1	9	4	1
117–2			117–3	16	10	5
117–3			118–1a	21	3	3
118–1			118–1b	5	3	6
			118–2a	8	4	6
118–2			118–2b	2	4	9
			119–1	3	10	8
119–1						
			130–1	28	4	1

1986–1989 Field Number	ples	Other Comments	1989–1990 Field Number	1989–1990 Field Acres	Crop 1989–1990 (1–27)	Tillage (Primary) Fall 89
			121–1	37	4	3
121–1c						
121–1a						
121–2	3 diff var		121–2	36	4	7
121–3			121–3	48	4	3
121–4			129–1	24	7	7
121–5			129–2	24	22	6
122–1			122–1	10	15	9
122–2			122–2	16	28	3
122–2a						
122–3			122–3	15	15	14
122–4			122–4	20	28	3
122–5			122–5	9	15	9
123–1			123–1	29	4	6
124–1a			124–1a	17	4	3
124–1b			124–1b	31	4	5
			124–1c	2	4	9
125–1			125–1	43	4	1
126–1a			126–2	21	6	1
126–1b						
126–1c						
126–2a			126–3a	14	4	3
126–2b			126–3b	8	4	9
126–3			126–4	24	4	1
126–4			*126–1a	10	4	3
			*126–1b	20	4	3
127–1			127–1	16	4	6
127–2a			*127–2a	20	4	3
127–2b	2 diff var		*127–2b	16	4	3
127–2c			*127–2c	16	4	3
127–3			127–3	72	3	9
127–4			127–4	42	7	8
127–5			127–5	36	4	6
201–1			201–1	5	15	14
201–2			201–2	16	1	1
201–3			201–3	25	17	14
			201–4	20	17	14
201–4			201–5	20	17	14
201–5			201–6	23	16	14
201–6			201–7	30	15	14
201–7	alfalfa					

1988–1989 Field Number	ples	Other Comments	1989–1990 Field Number	1989–1990 Field Acres	Crop 1989–1990 (1–27)	Tillage (Primary) Fall 89
			202–1	16	15	14
202–1	alfalfa		203–1	30	3	1
203–1						
203–2			203–3	15	15	14
203–3	alfalfa		203–4	25	7	1
203–4			204–1	45	4	1
204–1			205–1	90	3	1
205–1						
			205–2	33	4	1
205–2			206–1	45	3	1
206–1			206–2	45	3	1
206–2			207–1C	45	3	1
207–1C			207–2C	30	3	1
207–2C			224–3	40	30	4
208–1			224–2	15	4	1
208–2			216–3C	10	4	6
216–3C			216–4C	26	3	1
216–4C			216–5C	5	3	9
216–5C			216–6C	5	7	10
216–6C						
			216–6C	14	4	1
216–6C			216–7C	5	4	6
			216–7C	20	4	3
			218–11	34	4	1
218–11			218–12	36	7	1
218–12						
218–14			218–21	23	7	5
218–21						
			218–23	20	9	1
218–23			218–4C	5	3	10
218–4C						
			218–5C	5	4	10
218–5C			218–5C	7	4	3
			218–6C	4	3	3
218–6C			218–7C	6	7	10
218–7C			218–3C	5	3	3
218–3C						
			218–13	36	3	1
218–13						
			207–T1	28	4	1
207–T1						
207–T2			209–1	6	3	1
209–1			209–2	20	3	1
209–2a	130 bu/ac – not sure if for 2a or 2b					
209–2b			209–3	14	7	10
209–3			209–4	20	4	4
209–4						
			209–5	20	3	1
209–5						
			210–1	14	3	5
210–1			210–2	17	2	1
210–2			210–3a	20	4	1
210–3			210–3b	6	4	5
			210–4	36	4	1
210–4						
			210–5a	13	2	5

1988–1989 Field Number	ples	Other Comments
210–5		
212–1		
212–2		
212–3		
213–7		
213–1		
213–4		
213–5		
214–1		
215–1		
215–2		
216–11		
216–12		
216–1T		
216–2T		
216–3T		
216–4T		
216–5T		
216–6T		
216–6T		
217–1		
217–2	alfalfa	
217–3	pasture	
218–1T		
218–23		
218–24		
218–25	fallow	
218–25		
218–26		
218–27		
218–2T		
218–3T		
218–4T		
218–4T		
218–5T		
218–7T		
218–13		
219–1	not harvested	
219–2		
219–3		
219–4		
219–5		
220–1		
220–2		
220–3a		
220–3b	fallow	
220–5		
220–4		

1989–1990 Field Number	1989–1990 Field Acres	Crop 1989–1990 (1–27)	Tillage (Primary) Fall 89
210–5b	26	2	1
212–1	7	4	6
212–2	25	9	6
212–3	11	7	6
213–7	6	15	14
213–1	8	17	14
213–4a	2.5	1	5
213–4b	2.5	3	5
213–5	4	4	5
214–1	18	3	1
*224–1a	14	3	9
*224–1b	14	3	9
216–11	13	7	10
216–12	15	4	2
216–1	33	4	6
216–2T	7	4	10
216–3T	1	4	6
216–4T	3	3	1
216–5T	3	3	10
216–6T	3	7	10
216–7T	5	4	6
216–7T	5	4	3
217–1	35	6	1
217–2	40	3	1
217–3	10	17	14
218–1T	10	3	3
218–23	8	9	10
218–24	10	3	3
218–25	7	7	1
218–26	12	3	3
218–27	18	4	3
218–2T	16	7	10
218–3T	36	3	3
218–4T	10	3	10
218–5T	5	4	10
218–7T	2	7	10
218–13	6	3	1
219–1	10	7	10
219–2	9	7	10
219–3a	6	4	10
219–3b	10	4	3
219–4	4	7	10
219–5	2	4	3
220–1	8	4	9
220–2	8	4	9
*220–3a	12	7	8
*220–3b	10	7	8
220–5	10	17	14
220–4	13	23	9
221–1	17	7	10

1988–1989 Field Number	ples	Other Comments	1989–1990 Field Number	1989–1990 Field Acres	Crop 1989–1990 (1–27)	Tillage (Primary) Fall 89
221–1			221–2	13	4	10
221–2			221–3–	9	32	9
221–3	25 bu/ac – not sure if for 3–6a or 3–6b					
221–4–						
			222–1	5	7	6
222–1			222–2	9	3	6
222–2						
			control			
			301–4	7	24	1
301–4			302–1	15	10	7
302–1			302–2	31	3	2
302–2						
			303–1a	14	24	1
303–1			303–1b	4	10	6
			303–1c	7	3	9
			303–2	12	10	6
303–2			303–3	35	24	1
303–3			306–1	18	15	14
306–1			306–2	20	3	9
306–2			306–3	6	3	9
306–3			306–4	21	3	9
306–4			306–5	19	3	9
306–5	5 diff var		307–1a	10	24	9
307–1			307–1b	56	1	9
			307–3	35	1	9
307–3			307–4	11	3	1
307–4						
			312–1	20	7	1
307–5*						
307–5*			307–6	15	3	1
307–6			308–1	5	25	1
308–1			309–1	11	15	14
309–1						
			309–3a	19	25	1
309–3			309–3b	3	1	1
			309–4	16	7	1
309–4	alfalfa		310–1	32	3	9
310–1	6 diff var		310–2	60	3	9
310–2			310–3	6	3	9
310–3			311–1	12	27	9
311–1						
			311–2	5	27	9
311–2			311–3	12	27	9
311–3			311–4	24	24	1
311–4			312–5	9	25	1
			317c–7	17	24	1
312–5						

1988–1989 Field Number	ples	Other Comments	1989–1990 Field Number	1989–1990 Field Acres	Crop 1989–1990 (1–27)	Tillage (Primary) Fall 89
317C–7			323–2	20	24	1
			330–4a	6	25	1
323–2			330–4b	6	3	1
330–4a			330–3a	8	26	1
330–4b			330–3b	4	3	1
330–3a			330–2a	6	3	1
330–3b			330–2b	6	26	1
330–2a			330–1a	8	3	1
330–2b			330–1b	4	16	14
330–1a			328–1	14.8	3	1
330–1b			328–2	36.6	15	14
328–1						
328–2			328–3	11.1	3	1
			328–4	15.8	3	1
			328–5	21.5	na	na
328–5			328–6	7.9	16	14
			331–1	32	24	1
328–6						
304–1						
304–2						
304–3			test			
			313–2	5.4	17	14
			313–1a	9	15	3
313–2			313–1b	2	3	2
313–1			314–1	14	15	14
			314–2	14	15	14
314–1			314–3a	14	3	3
314–2	alfalfa		314–3b	3	32	14
314–3			315–1	20	3	3
			315–13	4	3	9
315–1			315–2	20	10	6
315–13			315–3	8	10	8
315–2			315–4	30	3	3
315–3			315–5	10	3	3
			315–6a	12	3	9
315–4			315–6b	2	32	14
315–5			315–7	7	15	14
315–6			315–8a	23	4	9
			315–8b	12	23	9
315–7	alfalfa		315–9	5	7	9
315–8a	122 bu/ac – not sure if for 8a or 8b		316–1	12	3	3
315–8b			316–2	16	4	3
315–9			316–3	15	3	3
316–1			317–1	48	3	9
316–2			317–2	5	24	3
316–3			317–21	7	24	3
317–1			317–3	4	1	9
317–2			317–6	25	3	3
317–21						
317–3			318–1	18	15	14
317–6						
			318–2a	10	7	10
318–1			318–2b	8	24	6
			318–2c	7	16	14
318–2a			318–2c	1	29	9

1988–1989 Field Number	ples	Other Comments	1989–1990 Field Number	1989–1990 Field Acres	Crop 1989–1990 (1–27)	Tillage (Primary) Fall 89
318–2b			318–3a	1	3	9
			318–3b	1.5	7	10
318–2c			318–3c	2.5	24	9
318–3a			318–4a	8	17	14
318–3b			318–4b	1	29	9
318–3c			318–5	9	3	2
318–4	alfalfa		319–1a	23	3	1
318–5			319–1b	19	3	1
319–1	Pioneer Research Stn		319–1c	6	31	1
			320–1a	23	26	2
			320–1b	5	29	9
			320–2a	15	24	5
320–1a	96 bu/ac – not sure if for 1a or 1b		320–2b	10	3	9
320–1b			320–3a	8	24	2
320–2a			320–3b	4	24	9
320–2b			320–4	11	24	9
320–3			320–5	11	16	14
320–4	alfalfa		320–6	6	29	2
320–5a			320–7	3	17	14
320–5b			322–1	15	16	14
320–6			322–2	7	25	1
320–7	pasture		322–6	4	4	1
322–1	alfalfa		323–1	4	10	5
322–2	4 diff var		325–2	12	10	7
322–6						
323–1			325–3	8	25	9
325–2			325–4	5	16	14
			326–31	21	3	13
325–3			326–32	8	3	13
325–4			326–32	3	3	9
326–31			326–32	10	3	5
326–32			326–32	7	3	2
			326–33	19	4	13
			326–34	22	10	13
			326–41	17	3	5
326–33			326–42	10	3	5
326–34			326–43	5	24	5
326–41			326–44	5	24	2
			324–1	21.5	16	14
326–43			324–2	8.1	3	1
326–44						
324–1	hay					
324–2	hay					

1989–1990 Field Number	Secondary Tillage 1989–90												ACTUAL Cover 04/90 %	EST. Cover 04/90 %	ACTUAL Cover 06/90 %	EST. Cover 06/90 %
101–1														5		5
101–2														70		70
101–3														5	2	
101–4														70		70
102–1													83.3			70
103–1	7\3\2		7\3\2		7								11.3		1.5	
103–2	7\3\2		7\3\2		7								17		1.3	
103–3	6												54.6		50.5	
*128–1a													17.2		3	
*128–1b													17.2		3	
104–2	7												90.6			70
104–5														5	4.8	
104–4	7	7/3		7/3									28.8		4.8	
105–11	1	7	8	2\3		6	7	8	2\3				8.8		1.6	
105–12	1	7	8	11	2\3									35	5	
106–1	1\3		1\3		1\3		1\3						83		5.3	
106–2														70		70
107–4	1	11	1	11	11	7	1	11	7\2\3		7\2\3	12	22.5		1	
108–1	6\2\3													5	1.3	
108–3	6\2\3		6\2\3		4	6								5	1.5	
108–2	6\2\3													5	2	
108–4	6\2\3													5	1.4	
109–1	6	6	2\3		7	4	6						14.6		1.7	
110–1	1\3		1\3		springtooth								28.2			5
111–1	12	7/3		7/3		7/3		7/3					6.7		0.7	
112–17	2												87.3			70
113–1	7\3		7\3		7\3									5		15
113–2	7\3		7\3		5									5	4	
test																
114–1	12	12											60.5			70
*114–4a	7\3		4											70		25
*114–4b	7\3		4											70		25
114–2	7	7\3		7\3		4	4	7\2\3		12			48		1	
114–3	7\2\3		7\2\3										60.3		4.7	
115–1	7		7\2\3										2.7		0.8	
*115–2a	7		7\2\3		7\2\3								6		1.8	
*115–2b	7		7\2\3		7\2\3								6		1.8	
116–1	1	6	6	1\2\3		7\2		4					88.8		8.5	
116–2													72.8			70
116–3	1	6	6	1\2\3		7\2		7\2					87.2		4	
116–4													59.3			70
117–2														70		25
117–1	7													5		5
117–3													98		26	
118–1a	6	7											14.6		7.1	
118–1b	6	7												70		15
118–2a	7	3												35		25
118–2b	7	3												70		25
119–1	7	3											71.3		45.5	
130–1														5		5

1989–1990 Field Number	Secondary Tillage 1989–90									ACTUAL Cover 04/90 %	EST. Cover 04/90 %	ACTUAL Cover 06/90 %	EST. Cover 06/90 %
121–1	1	7	4	5	5						15	4.3	
121–2	7\3		7\3		7	4	5	5		45.6		6	
121–3	7	7	4	4	5					17.8		3.5	
129–1	5	5								88.3			70
129–2	7/3/2		7/3/2							33.1		3.7	
122–1										31.4		4.2	
122–2	6\2\3		6							19.2		6.4	
122–3											70		70
122–4	6	6	6							22.9		2	
122–5											70		70
123–1	1/2/3		1/2/3		7/3		7/3	5		58.8		20.6	
124–1a	7	7	7								15		5
124–1b	7	7	7							56.5		5.5	
124–1c											70		15
125–1	12	6	2/3		6/3/2		6/3/2		12	11.2		5.5	
126–2	1/3/2		1/3/2							3		2.4	
126–3a	1	1								4.3		1	
126–3b	1	1									70		15
126–4	1	1								8.3		1.7	
*126–1a	1	1									5		5
*126–1b	1	1								8.3		2	
127–1	7/3/2									40.7		19.3	
*127–2a	1	7/3/2									5		5
*127–2b	1	7/3/2									15		5
*127–2c	1	7/3/2									5		5
127–3	1	7/3								88.8		11.1	
127–4	12									55			70
127–5	1	7								34.7		11	
201–1											70		70
201–2	7	7	5									8.4	
201–3											70		70
201–4											70		70
201–5											70		70
201–6											70		70
201–7											70		70

1989−1990 Field Number	Secondary Tillage 1989−90						ACTUAL Cover 04/90 %	EST. Cover 04/90 %	ACTUAL Cover 06/90 %	EST. Cover 06/90 %
202−1	1							70		70
203−1	1	6	6	4	7		10.1		8.7	
203−3								70		70
203−4	1	2/3					45.7			70
204−1	6	6	6				2		2.8	
205−1	7						8.4		6.2	
205−2	7						17.6		10.4	
206−1	7	7	7	5			8		2	
206−2	6	6	6	5			10.3		12.5	
207−1C	7	7	7				12.4		8	
207−2C	7	7	7				3.7		4.8	
224−3	6	6					24.2		6	
224−2	6	6					15.2		9.3	
216−3C	6	6	6	7	5		41		2.5	
216−4C	6	6	7	4	5		6		3.33	
216−5C	6	6					64.6		17.3	
216−6C							64			70
216−6C	6	6	6	7	5		27		9.4	
216−7C								70		15
216−7C								15		15
218−11	7	7	7	7	6	4	17.6			5
218−12	6						20.8			70
218−21	1	6					66.8			70
218−23	10	6	6	2/3			5.3		2.8	
218−4C							68		39.3	
218−5C	6	6					91.3		80.4	
218−5C	4							15		15
218−6C	6	5					21.3		10.7	
218−7C								70		70
218−3C	4						23.8			25
218−13	6	7	4				12.3			5
207−T1	7						85.3		7.7	
209−1	7	7	7				12		7.3	
209−2	7	7	7				12.3		8.8	
209−3							80.7			70
209−4	1	1	7				51.5		18.9	
209−5	1	1	7	7			17		3.5	
210−1	7	7					27		3	
210−2	7	7	7	7			10.4		4.4	
210−3a	7	7					12.6		1.4	
210−3b	7	7						35		25
210−4	7	7					8.3		1.25	
210−5a	7	7						35		25

1989–1990 Field Number	Secondary Tillage 1989–90					ACTUAL Cover 04/90 %	EST. Cover 04/90 %	ACTUAL Cover 06/90 %	EST. Cover 06/90 %
210–5b	7	7				5.6		1	
212–1	6/3						70		5
212–2	6						70		15
212–3							70		70
213–7							70		70
213–1							70		70
213–4a	7	9	7			21.3		4.6	
213–4b	7	9	7			21.3		4.6	
213–5						10		6	
214–1							5		5
*224–1a	6	6	6	6		38.5			25
*224–1b	6	6	6	6		94.5		2.6	
216–11						36.7			70
216–12	6	6	6	7		17.5		6.5	
216–1	6	6	6	7	5	37.1		3.2	
216–2T						86		19.6	
216–3T						41		2.5	
216–4T	6	6	7	4		6		3.33	
216–5T	4	5				64.6		23.5	
216–6T							70		70
216–7T	6	6	6	7	5	33.6			15
216–7T	6	6	6	7	5	24.5		3.2	
217–1	6					7		2	
217–2	6					5.2		3.3	
217–3							70		70
218–1T	6	5				33.3		23.3	
218–23						82			70
218–24	6	6	6	5			15	6	
218–25	1	6	6			45.5			70
218–26	6	6	6	5		3.5		3	
218–27	6	6	6	6		17		2.8	
218–2T	6					62			70
218–3T	6	6	5			23.8		12.3	
218–4T	5					68		39.3	
218–5T	4					88.7		81	
218–7T						65.6			70
218–13							5		5
219–1						21.3			70
219–2						46.7			70
219–3a						46		65.5	
219–3b	6	6	8	4		20		4.8	
219–4						55.3			70
219–5						34.7		6	
220–1	10	1	1	6	6/2/3	96.5		12.7	
220–2	10	1	1	6	6/2/3	55		2.7	
*220–3a	6					88.5			70
*220–3b	6	1				37.6			70
220–5							70		70
220–4							70		5
221–1						77.6			70

1989–1990 Field Number	Secondary Tillage 1989–90									ACTUAL Cover 04/90 %	EST. Cover 04/90 %	ACTUAL Cover 06/90 %	EST. Cover 06/90 %
221–2										90		72	
221–3–										100			70
222–1										47			70
222–2											70		5
control													
301–4	6	6	5							7.3		8	
302–1										12			70
302–2										10.3		19	
303–1a	6	5								14		5	
303–1b	6									15.3			70
303–1c	6	3/2	5							23.7		6.7	
303–2	6									17		48	
303–3	1/2	6	1/2	7	1/2	6	1/2	7	3/2	4.8		9.8	
306–1											70		70
306–2	10	6	3/2	6						90.8		11.2	
306–3	6									80.7		12	
306–4	10	1	6	3/2						89		10	
306–5	10	1	6	3/2	6					91.6		7.6	
307–1a	1	6	6							97.8		5.3	
307–1b	1	6	6	9	1					95.3		3.5	
307–3	1	1	6	9							70	8.8	
307–4	6	6								9.5		14	
312–1										12			70
307–6	6	6								13.2		9	
308–1	6	6	2							2		2.7	
309–1											70		70
309–3a	6	6	2	2						4		6.7	
309–3b	6	6	2	2	2	3					5	8.7	
309–4	1	6	6	1						23.6		61.5	
310–1	1	2								97.3		7.5	
310–2	1	2								94.8		7.1	
310–3	1	2								91.3		10	
311–1	1	3	6	3	5	5				94.6		5	
311–2	1	3	6	3	5	5				95		6	
311–3	1	3	6	3	5	5				94.6		3.5	
311–4	3	6	3	5						10.7		1.7	
312–5	1	7	7	2	3					18		4	
317c–7	6	6	6	5						5.2		11.2	

1989–1990 Field Number	Secondary Tillage 1989–90							ACTUAL Cover 04/90 %	EST. Cover 04/90 %	ACTUAL Cover 06/90 %	EST. Cover 06/90 %
323–2	6							5.2		7.3	
330–4a									5		70
330–4b									5		5
330–3a									5		70
330–3b									5		5
330–2a									5		5
330–2b									5		70
330–1a									5		5
330–1b									70		70
328–1									5		5
328–2									70		70
328–3									5		5
328–4									5		5
328–5									70		70
328–6									70		70
331–1	6	5						5		7.8	
test											
313–2									70		70
313–1a									15		5
313–1b	7	7	2	3				22.5		26	
314–1									70		70
314–2									70		70
314–3a	4	4							15	16	
314–3b	4	4						75.5		65	
315–1	1	8	7	1	8			11.3		10	
315–13	1	1	1	7	1	8		82		23.3	
315–2	1	1	7					94.7			70
315–3	7							91			70
315–4	1	8	7	1	8			10		13	
315–5	7	1	8					10.5		13.3	
315–6a	1	1	8	1	8			94		11	
315–6b									70		70
315–7									70		70
315–8a	1	1	8	7	1	8		94.8		11.3	
315–8b								94.8			5
315–9								89.3			70
316–1	1	2	7	1	2	8			15	13.5	
316–2	7	7	1	2	8				15	10	
316–3	1	2	7	1	2	8	5		15	17	
317–1	10	9	6	5				78.8		2.5	
317–2	6	6	6	5				10		6.7	
317–21	6	6	6	5					15	2.7	
317–3	10	9	6	5				56.6		2.7	
317–6	6	6						11		0.5	
318–1									70		70
318–2a								84		94	
318–2b	1	1	1	3	5			73		13	
318–2c	1	9	1	1	5				70		70
318–2c	1	9	1	1	5				70	18	

1989-1990 Field Number	Secondary Tillage 1989-90							ACTUAL Cover 04/90 %	EST. Cover 04/90 %	ACTUAL Cover 06/90 %	EST. Cover 06/90 %
318-3a								90		9	
318-3b									70		70
318-3c									70	8.7	
318-4a									70		70
318-4b									70	7.3	
318-5	1	9						23.3		24	
319-1a	6	6	2					7.6		7.6	
319-1b	6	6	2					4.8		6	
319-1c	6	6	2					11.3			15
320-1a	5	7	7	3/2				4.7			70
320-1b	7	4	5					94		12.5	
320-2a	5	7	7	5				24		4	
320-2b	5	1	7	7	4	5		99.6		10.7	
320-3a	5							3		12.5	
320-3b	5								70		5
320-4	5							69.5		26.5	
320-5								78.5			70
320-6	6	6	6	5				7.3		10	
320-7									70		70
322-1								97.5			70
322-2	6	6						14.7		12	
322-6								13.3		10	
323-1								51.3			70
325-2								56.5		64.7	
325-3	1	1	2	2	4			88.7		4	
325-4								98			70
326-31	para-	10	7	7	4			72.4		3.3	
326-32	para-	chisel	1	4	10	7	7		70		5
326-32	para-	chisel	1	4	10	7	7		70		5
326-32	para-	chisel	1	4	10	7	7		25		5
326-32	para-	chisel	1	4	10	7	7		5		5
326-33	para-	10	7	7	7	5		58.8		2.3	
326-34	para-	7	7					50.6		42.5	
326-41	7	4						32.8		5.5	
326-42	7	4						40		9.3	
326-43	7	7	4	5				13.3		1.3	
326-44	7	7	4	5				27.3		10.7	
324-1									70		70
324-2									5		5

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1989– 1990 Field Number	ACTUAL Cover 09/90 %	EST. Cover 09/90 %	Yield 1990	Units	Sourc	# Samples	Other Comments
101–1	80.5		na	bu/ac			
101–2	86.5		na	bu/ac			
101–3	82.8		na	bu/ac			
101–4	83		na	bu/ac			
102–1	86.7		na	bu/ac			
103–1	81.3		32.7	bu/ac	ww	1	
103–2	81.3		39.2	bu/ac	ww	1	
103–3	79.3		94	bu/ac	est		
*128–1a		70	na				
*128–1b		70	na				
104–2	79.3		83.15	bu/ac	ww	2	
104–5	80		48	bu/ac	est		
104–4	87.5		39	bu/ac	ww	1	
105–11	83.5		42.9	bu/ac	est		2 varieties
105–12	48		5.2	ton/ac	est		
106–1	77.3		29.5	bu/ac	ele		
106–2	84			bu/ac			
107–4	82.4		40.7	bu/ac	ww	1	
108–1	85.3		54	bu/ac	est		–combined with 108–3
108–3	82.8		54	bu/ac	est		–combined with 108–1
108–2		70	4.7	ton/ac	est		
108–4		70	4.7	ton/ac	est		
109–1	79		109	bu/ac	ww	2	
110–1		70	39	bu/ac	est		–at 15.5% moisture
111–1	79.5		114.3	bu/ac	est		source–crop insurance results
112–17		70	na	bu/ac			alfalfa
113–1	79.3		56.4	bu/ac	ele		
113–2	76.4		111.6	bu/ac	ww	2	
test							
114–1	84.3		72.8	bu/ac	ww	2	
*114–4a	89		39.2	bu/ac	ww	1	
*114–4b		70	39.2	bu/ac	ww	1	
114–2	83.4		42.7	bu/ac	ww	1	
114–3	90.7		45.8	bu/ac	ww	1	
115–1	81.6		36	bu/ac	est		
*115–2a		70	1	ton/ac	est		
*115–2b		70	1	ton/ac	est		
116–1	86.7		41.8	bu/ac	ww	1	
116–2	88.4		71.75	bu/ac	ww	2	
116–3	90.8		57.4	bu/ac	ww	1	
116–4	81.3		71.8	bu/ac	ww	2	
117–2	80.7		55	bu/ac	est		
117–1	75.3		54	bu/ac	ww	1	
117–3	84		82.5	bu/ac	ww	1	
118–1a	83.5		na	bu/ac	ww	2	166.6 bu/ac – not sure if for 1a or 1b
118–1b		70	na	bu/ac	ww	2	
118–2a	93.6		na	bu/ac	ww	3	47.5 bu/ac – not sure if for 2a or 2b
118–2b		70	na	bu/ac	ww	3	
119–1	88.5		71.1	bu/ac	ww	2	–no till & conventional
130–1	79.1		na	bu/ac			

1989–1990 Field Number	ACTUAL Cover 09/90 %	EST. Cover 09/90 %	Yield Units 1990	Sourc	# Samples	Other Comments
121–1	86.2		50.8 bu/ac	ww	2	
121–2	77		37.4 bu/ac	ww	2	
121–3	83.5		41.5 bu/ac	ww	2	
129–1	82.3		80.3 bu/ac	ww	2	
129–2	87.7		1355 bu/ac	est		
122–1		70	na bu/ac			alfalfa
122–2	78.4		37.2 bu/ac	ww	1	
122–3		70	na bu/ac			alfalfa
122–4	79.2		36.5 bu/ac	ww	1	
122–5		70	na bu/ac			alfalfa
123–1	89.9		54.4 bu/ac	ww	1	
124–1a	79.3		na bu/ac	ww	2	45 bu/ac – not sure if for 1a, 1b, or 1c
124–1b		70	na			
124–1c		70	na			
125–1	80.3		48 bu/ac	ele		
126–2		70	1171 lb/ac	ele		
126–3a	79.6		na bu/ac	ele		–flds 126–1,3&4 harvested together
126–3b		70	na			45.8 bu/ac – based on MB, MMB, or no fall t.?
126–4	81.3		na bu/ac	ele		–flds 126–1,3&4 harvested together 45.8 bu/ac – based on MB, MMB, or no fall t.?
*126–1a	81.5		na bu/ac	ele		–flds 126–1,3&4 harvested together
*126–1b		70	na bu/ac	ele		45.8 bu/ac – based on MB, MMB, or no fall t.?
127–1	80.6		40.2 bu/ac	ww	3	
*127–2a	84.8		41.5 bu/ac	ww	1	2 varieties
*127–2b		70	41.5 bu/ac	ww	1	2 varieties
*127–2c		70	41.5 bu/ac	ww	1	2 varieties
127–3	79.8		128.3 bu/ac	ww	3	3 varieties
127–4	85.5		89.6 bu/ac	ww	1	
127–5	83.3		44.4 bu/ac	ww	1	
201–1		70	na bu/ac			hay
201–2	70	70	na bu/ac			
201–3		70	na bu/ac			pasture
201–4		70	na bu/ac			pasture
201–5		70	na bu/ac			pasture
201–6		70	na bu/ac			hay
201–7		70	na bu/ac			hay

1989–1990 Field Number	ACTUAL Cover 09/90 %	EST. Cover 09/90 %	Yield 1990	Units	Sourc	# Samples	Other Comments
202–1		70	na	bu/ac			hay
203–1	91		115	bu/ac	ele		
203–3		70	na	bu/ac			hay
203–4		70	64.7	bu/ac	ww	1	
204–1	74.4		29.9	bu/ac	ele		
205–1	89.2		124.8	bu/ac	ww	3	
205–2	79.6		50	bu/ac	ele		
206–1		70	67.8	bu/ac	ele		
206–2	84.9		88.6	bu/ac	ele		
207–1C	85.4		128.6	bu/ac	ele		
207–2C		70	127.1	bu/ac	ele		
224–3		70	2	ton/ac	est		
224–2	79.7		45	bu/ac	ele		
216–3C		70	40	bu/ac	ele		
216–4C	84.8		138.2	bu/ac	ele		
216–5C	98.8		116.9	bu/ac	ele		
216–6C		70	81.9	bu/ac	ele		
216–6C	84.8		39	bu/ac	ele		
216–7C		70	na	bu/ac	ele		39 bu/ac – not sure if for 7a or 7b
216–7C		70	na				
218–11	90.8		37.6	bu/ac	ele		
218–12	94.9		65.5	bu/ac	ww	2	
218–21	94.6		55.5	bu/ac	ww	4	2 varieties
218–23	99.5		48.7	bu/ac	ww	1	
218–4C	82.3		59.3	bu/ac	ww		
218–5C	94		33.9	bu/ac	ww		
218–5C		70	na				
218–6C	90		106.1	bu/ac	ww		
218–7C	95.3		76.1	bu/ac	ww	4	–av of unfert & fert data recorded
218–3C	82		97.8	bu/ac	ww		
218–13	80.3		54.5	bu/ac	ele		
207–T1	84.6		48.8	bu/ac	ele		
209–1	90.5		145	bu/ac	est		
209–2	89.5		142.3	bu/ac	ww	3	
209–3	91.2		72.2	bu/ac	ww	4	
209–4	90		28.7	bu/ac	ele		
209–5	91.5		123.1	bu/ac	ww	2	
210–1		70	139.9	bu/ac	ww	1	
210–2	82.5		4.6	ton/ac	ele		
210–3a	75.4		33	bu/ac	ele		
210–3b		70	33	bu/ac	ele		
210–4	88.4		42.4	bu/ac	WW	2	
210–5a	82.3		na	ton/ac	ele		5.2 bu/ac – not sure if for 5a or 5b

1989– 1990 Field Number	ACTUAL Cover 09/90 %	EST. Cover 09/90 %	Yield Units 1990	Sourc	# Samples	Other Comments
210–5b		70	na			
212–1	88.5		42.4 bu/ac	ele		
212–2		70	49 bu/ac	ele		
212–3		70	41 bu/ac	ele		
213–7		70	na bu/ac			alfalfa
213–1		70	na bu/ac			pasture
213–4a	26		137.9 bu/ac	ww		
213–4b	90.5		137.9 bu/ac	ww		
213–5	87.2		47.4 bu/ac	ele		
214–1		70	na			
*224–1a	90.4		133 bu/ac	est		
*224–1b		70	133 bu/ac	est		
216–11	98		76.4 bu/ac	ele		
216–12	78.7		38 bu/ac	ele		
216–1	88.8		39 bu/ac	ele		
216–2T	92.4		31.2 bu/ac	ele		
216–3T		70	40 bu/ac	ele		
216–4T	84.8		138.2 bu/ac	ele		
216–5T	98.7		116.9 bu/ac	ele		
216–6T		70	74.5 bu/ac	ele		
216–7T		70	na bu/ac	ele		39 bu/ac – not sure if for 7Ta or 7Tb
216–7T	89.3		na			
217–1		70	2 ton/ac	est		
217–2	88.7		135 bu/ac	est		
217–3		70	na bu/ac			pasture
218–1T	98		121 bu/ac	ww		
218–23	95.5		49.7 bu/ac	WW	2	SP & FALL PLOUGH
218–24	86.4		91.1 bu/ac	ele		
218–25	92.8		na bu/ac			fallow
218–26	86		91.1 bu/ac	ele		
218–27	90.9		22.3 bu/ac	ele		
218–2T	97.6		82.2 bu/ac	WW	1	
218–3T	82		97.8 bu/ac	ww	3	
218–4T	82.3		59.3 bu/ac	ww	3	
218–5T	95.3		36.1 bu/ac	ww		–rotary hoe & not rotary hoed in sp
218–7T		70	76.1 bu/ac	ww	4	–av of fert & non fert areas
218–13	80.3		54.5 bu/ac	ele		
219–1	97.3		73.8 bu/ac	ww	1	
219–2	99		73.8 bu/ac	ww	1	
219–3a	87		18.75 bu/ac	ww	1	no till & conventional
219–3b	48		14.9 bu/ac	ww	1	
219–4	97.3		54.5 bu/ac	ww	1	
219–5	95.3		24 bu/ac	est		
220–1	79.2		28.6 bu/ac	ele		
220–2	79.2		na			
*220–3a	88		na bu/ac			
*220–3b		70	na			
220–5		70	na bu/ac			pasture
220–4		5	na bu/ac			fallow
221–1	99.5		52 bu/ac	ele	1	–to be confirmed by ele slips

1989– 1990 Field Number	ACTUAL Cover 09/90 %	EST. Cover 09/90 %	Yield 1990	Units	Sourc	# Samples	Other Comments
221–2	92		20.6	bu/ac	ele	1	
221–3–		70	na				
222–1		70	na	bu/ac			
222–2		70	na	bu/ac			
control							
301–4	60.7		1000	lb/ac	est		
302–1	82.2		85	bu/ac	ww	1	
302–2	94.8		98.9	bu/ac	ww	3	–3 varieties
303–1a	42		1100	lb/ac	est		
303–1b	98.7		92	bu/ac	est		
303–1c	85.3		130.7	bu/ac	ww	1	
303–2	98.5		92.7	bu/ac	ww	1	
303–3	46.5		1100	lb/ac	est		
306–1		70	na				alfalfa
306–2	84		119	bu/ac	ww	1	
306–3	88		122	bu/ac	ww	1	
306–4	82.8		123	bu/ac	ww	1	
306–5	83.6		106.5	bu/ac	ww	7	–7 plots, 7 varieties
307–1a	40		1600	lb/ac	est		
307–1b	49.7		na	bu/ac			
307–3	18		na	bu/ac			
307–4		70	na	bu/ac			
312–1	86.7		46.9	bu/ac	ww	1	–yld taken outside w/s but same practices
307–6		70	na	bu/ac			
308–1		70	63.5	bu/ac	ww	1	
309–1		70	na	bu/ac			hay
309–3a	88.5		79.4	bu/ac	ww	1	
309–3b		70	na	bu/ac			
309–4	83.6		69.5	bu/ac	ww	1	
310–1		70	144.8	bu/ac	ww	1	
310–2		70	131.6	bu/ac	ww	2	
310–3		70	150.8	bu/ac	ww	1	
311–1	93		122.9	bu/ac	ww	2	–2 vareites
311–2	95.3		121.5	bu/ac	ww	1	
311–3	94		131	bu/ac	ww	1	
311–4		70	2000	lb/ac	est		
312–5		70	90.3	bu/ac	ww	1	
317c–7	69.6		1200	lb/ac	ele		

1989– 1990 Field Number	ACTUAL Cover 09/90 %	EST. Cover 09/90 %	Yield 1990	Units	Sourc	# Samples	Other Comments
323–2	59.2		2500	lb/ac			
330–4a		70	na				
330–4b		70	na				
330–3a		70	na				
330–3b		70	na				
330–2a		70	na				
330–2b		70	na				
330–1a		70	na				
330–1b		70	na				hay
328–1		70	na				
328–2		70	na				alfalfa
328–3		70	na				
328–4		70	na				
328–5		70	na				
328–6		70	na				hay
331–1		70	2700	lb/ac	est		
test							
313–2		70	na	bu/ac			pasture
313–1a		70	na	bu/ac			alfalfa
313–1b		70	na	bu/ac			hay
314–1		70	na	bu/ac			alfalfa
314–2		70	na	bu/ac			alfalfa
314–3a	84.5		136.8	bu/ac	ww	1	
314–3b		70	na				alfalfa
315–1	86.3		120	bu/ac	ww	1	–2 varieties
315–13	90		141.3	bu/ac	ww	1	
315–2	99.6		85	bu/ac	ww	1	
315–3	99.3		90.5	bu/ac	ww	1	
315–4	86.5		134.5	bu/ac	ww	2	–2 varieties
315–5	88.7		142.9	bu/ac	ww	1	
315–6a	88		120.6	bu/ac	ww	1	
315–6b		70	na				
315–7		70	na	bu/ac			alfalfa
315–8a	89		45	bu/ac	ele		
315–8b		5	na	bu/ac			
315–9	87.3		na	bu/ac			
316–1	93		128.5	bu/ac	ele	1	
316–2	80.4		45	bu/ac	ele		–dry weight
316–3	86.7		118	bu/ac	ww	2	–2 varieties
317–1	93.5		140	bu/ac	ele		
317–2		70	1000	lb/ac	ele		
317–21	52.7		700	lb/ac	ele		
317–3	37.3		20	MT/ac	est		
317–6	88.7		140	bu/ac	ele		
318–1		70	na	bu/ac			–2nd cut hay 1800 sq bales(est)
318–2a	81.3		44.7	bu/ac	est		
318–2b	47		1700	lb/ac	est		
318–2c		70	na				–2nd cut hay 900 sq bales(est)
318–2c	50.7		1250	lb/ac	est		–combined with 318–4b

1989–1990 Field Number	ACTUAL Cover 09/90 %	EST. Cover 09/90 %	Yield 1990	Units	Sourc	# Samples	Other Comments
318–3a	81.3		120.8	bu/ac	ww	1	
318–3b	76		na	bu/ac			
318–3c	51.3		1700	lb/ac	est		
318–4a		70	na				pasture
318–4b	59.6		1250	lb/ac	est		–combined with 318–2c2
318–5	84		na	bu/ac			
319–1a		70	na	bu/ac			Pioneer Research Stn
319–1b	59.6		na	bu/ac			Pioneer Research Stn
319–1c		70	na	bu/ac			Pioneer Research Stn
320–1a	100		77.5	bu/ac	ww	1	
320–1b	67.2		2771	lb/ac	ele		–combined with 320–6
320–2a	47.5		1943	lb/ac	ele		–combined with 320–3 & 320–4
320–2b	80		125	bu/ac	ww		
320–3a	46		na	lb/ac	ele		–combined with 320–2a & 320–4; 1943 bu/ac
320–3b		70	na				– not sure whether for 3a or 3b
320–4	56		1943	lb/ac	ele		–combined with 320–3 & 320–2a
320–5		70	na	bu/ac			hay
320–6	48		2771	bu/ac	ele		–combined with 320–1b
320–7		70	na	bu/ac			pasture
322–1		70	na	bu/ac			hay
322–2	83.3		89.3	bu/ac	ww	1	
322–6	59.3		na	bu/ac			
323–1	98		85.9	bu/ac	ww	3	–3 varieties
325–2	81.3		61.3	bu/ac	ww	2	–2 varieties
325–3	92.5		71.6	bu/ac	ww	1	
325–4		70	na	bu/ac			hay
326–31	91		117	bu/ac	est		–combined with 326–32
326–32		70	na	bu/ac	est		–combined with 326–31 – however, not sure
326–32		70	na				which primary tillage practice was used
326–32		70	na				to achieve 117 bu/ac yield
326–32		70	na				
326–33	71		37.5	bu/ac	ele		
326–34	99.2		83	bu/ac	ele		
326–41	93		130	bu/ac	ele		–combined with 326–42
326–42	95.5		130	bu/ac	ele		–combined with 326–41
326–43	34.7		1800	lb/ac	ele		–combined with 326–43
326–44	54.7		1800	lb/ac	ele		–combined with 326–44
324–1		70	na				hay
324–2		70	na				

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1990–1991 Field Number	1990–1991 Field Acres	Crop 1990–1991 (1–27)	Tillage (Primary) Fall 90	Secondary Tillage 1990–91									
104–6	35	4	1	7/3		7/3							
104–7	50	3	1										
104–8	35	4	1	7/3									
104–9	15	4	1										
102–1	5	4	1										
103–1	40	7	7	7									
103–2	39	22	7	7	7	7	5	5	5				
131–1	49	3	1	7	7								
128–1	18	4	9										
104–2	44	4	1	1	6	7/3		7/11					
104–5	18	22	1	7	7/3	5							
104–4	50	4		7/3		7/3							
131–2	50	3	1										
129–12	11	4	1	7/3		7/3							
106–1	7	7	7										
106–2	2	4	1										
107–4	15	4	1	7\2\3			11	7\2\3					
108–5a	14	4	9	6\2\3									
108–5b	5	4	1	6\2\3									
108–4	25	4	1	6\2\3									
109–1	30	4	9	1\2\3		1\2\3		2\3		2\3		4	6
110–1	29	4	9	na									
111–1	10	4	1	1	7								
112–17	8	15	14										
132–1	18	4	9	1/3									
132–2C	23	4	9	10	1/3								
132–3C	5	3	9	10	1/3								
114–1													
114–4	24	4	9										
	8	4	10	7\2\3		7\2\3							
114–2													
114–3	17	4	10	7\2\3		7\2\3							
115–1	23	4	9	7\3		7\3							
115–2	18	4	1	7\2\3									
	49	2	8	7\2									
116–1													
116–2	8	23	9	1\2\3		7\2\3			11	11			
116–3	17	4	7	6	1	1	1\2\3		7\2\3		7\2\3		
116–4	17	4	9	1\2\3		1\2\3		1\2\3		7\2\3			
117–4	3	4	7	6	1	1	1	7\2\3					
	12	4	8										
117–3													
118–1a	16	4	2	7	7	7							
118–1b	6	4	3	4	7								
118–2	17	4	10	4	7								
	13	4	9										
119–1													
	3	3	1	7	7\3								
130–1													

1990–1991 Field Number	1990–1991 Field Acres	Crop 1990–1991 (1–27)	Tillage (Primary) Fall 90	Secondary Tillage 1990–91							
121–1	28	4	1	12							
	23	4	3	5	7						
121–2	22	4	10	5	7\2		7	1\2	7		
121–7	28	7	10								
121–3	24	4	3	5	7						
121–6	24	3	3	7\2		7					
129–1	24	2	2	1	7/3	5					
129–2	24	4	2	7/3		7/3					
122–1	10	15	14								
122–2	16	28	7								
122–3	15	3	9	8							
122–4	20	3	7	8							
122–5	9	4	9	10	7\2\3\8			7\2\3\8	7\2\3\8	7\2\3\8	7\2\3\8
123–1	29	4	9	12	7	7	7/3/2				
124–1	50	22	9								
125–1	43	4	2 v. plo		1	6	6/3/2	6/3/2 v. plow			
126–2	20	4	3	1							
126–3	27	4	9	1	1						
126–4a	20	4	3	1	1	1					
126–4b	2	4	2	1	1	1					
126–4c	1	4	9	1	1	1					
126–1	30	4	9	1	1						
127–1	16	4	9								
127–2	52	4	6								
127–3	72	4	5	1	7						
127–4	42	4	5	1	1						
127–5	21	3	6	2	2	7					
control											
201–1	5	3	1								
201–2	16	9	1	6							
201–3	25	17	14								
201–4	20	17	14								
201–5	20	17	14								
201–6	23	16	14								
201–7a	15	3	1	1	7	7					
201–7b	15	16	9								

1990-1991 Field Number	1990-1991 Field Acres	Crop 1990-1991 (1-27)	Tillage (Primary) Fall 90	Secondary Tillage 1990-91					
202-1	16	15	14						
203-1	30	4	1	6	6	6	6		
203-3	15	3	9	10	1	1	3	6	5
203-4	25	3	1	6	6	6	5		
204-1	45	2	9	1	6				
205-1	57	3	1						
205-3	33	3	1	7					
205-2	33	3	9	7					
206-1	45	3	9	1	6	5			
206-2	45	3	9	1	6	5			
207-1C	45	3	1	7	7				
207-2C	30	3	1	7					
224-3	40	2	8	1	6	6	6	5	
224-2	15	2	9	1	6	6	6	5	
216-3C	10	3	4	6	6/2				
216-4C	26	4	1	6	6	6	6	5	
216-5C	5	4	1	6	6	6	6	5	
216-6C	5	4	1	6	6	6	6	5	
216-6C	14	4	6	6	6	6	6	5	
216-7C	20	2	6	6	6	6			
218-11	23	4	7	6	7	6	2/3		
218-12	40	3	1	7	7	6			
218-21	23	3	3	10	1	6	6	5	
218-23	20	7	3	7	6				
218-4C	2	3	10						
218-4C	3	4	10						
218-5C	5	7	10						
218-5C	7	3	9	6	5				
218-6C	4	3	3	6	6	5			
218-7C	6	4	10						
218-3C	1.5	3	5						
218-3C	3.5	3	3						
218-13	30	4	1	7	7	6			
test									
207-T1	28	7	10						
209-1	6	3	1	7	7	7			
209-2a	6	3	9	1	7	7			
209-2b	14	3	3	10	1	7	7		
209-3	14	3	4	1	7	7			
209-4a	13	7	10						
209-4b	7	3	10						
209-5a	10	3	10						
209-5b	10	4	10						
210-1	14	3	1	7	7	7			
210-2	17	4	10						
210-3	26	3	10						
210-4a	20	4	4	7	7	7			
210-4b	25	10	10						
210-5	30	2	1	7	7	7			

1990–1991 Field Number	1990–1991 Field Acres	Crop 1990–1991 (1–27)	Tillage (Primary) Fall 90	Secondary Tillage 1990–91				
212–1	7	4	9	6	6			
212–2	25	4	6	6				
212–3	11	4	6	6	6			
213–7	6	15	14					
213–1	8	17	14					
213–4a	2.5	7	10					
213–4b	2.5	3	1	6	2/3			
213–5	4	7	10					
214–1	18	3	1					
224–1	28	6	4	1	6	6	6	2
216–11	13	4	10					
216–12	15	3	6	6	6	6	5	
216–1	26	3	10	5				
216–2	14	7	10					
216–3T	1	3	6					
216–4T	3	4	1	6	6	6	6	5
216–5T	3	4	1					
216–6T	3	4	6					
216–7T	15	2	6					
217–1	35	7	5	6	6			
217–2	40	2	5	1	6	6	6	5
217–3	10	17	14					
218–1T	10	4	10					
218–23	8	7	4					
218–24	10	4	3	6	6	6		
218–25	4	4	3	6	6	1	1	3/2
218–25	4	4	9					
218–26	12	4	10					
218–27	18	3	9	6	6	5		
218–2T	16	3	10					
218–3T	33	3	4	6	6	5		
218–3T	3	3	3					
218–4T	4	3	10	6	6			
218–4T	6	4	10					
218–5T	5	7	10					
218–7T	2	4	10					
218–13	6	4	1					
219–1	10	3	3	6	6	5		
219–2	9	3	9	1	6	6	8	5
219–3	16	7	10	6				
219–4	4	3	5	6	6	6	5	
219–5	2	7	10					
220–1	16	23	9	10	1	6	6	
220–3	22	25	8	1	1			
220–5	10	17	14					
220–4	13	4	1	1	1	6	3/2	
221–1	17	3	10					

1990–1991 Field Number	1990–1991 Field Acres	Crop 1990–1991 (1–27)	Tillage (Primary) Fall 90	Secondary Tillage 1990–91						
221–2	13	7	10							
221–3–	9	32	14							
222–1	5	3	8							
222–2a	4.5	4	9							
222–2b	4.5	25	9							
control										
301–4	7	3	9	6	6	2/3				
302–1	15	29	1	6	6	2/3	5			
302–2a	19	3	1	6	6	2/3	5			
302–2b	12	3	9	10	6	6	2/3	5		
303–1a/	18	3	1	6	6	2/3				
303–1c	7	3	9	6	6	6	2/3			
303–2	12	3	9	10	6	6	2/3			
303–3	35	3	9	10	6	6	2/3			
306–1	18	25	1	6	6	2/3				
306–2	20	3	9	10	6	6	2/3			
306–3	6	3	1	6	6	2/3				
306–4	21	3	9	10	6	6	2/3			
306–5	19	25	1	6	6					
307–1a	10	15	1	6	6	2/3				
307–1b	31	7	1	6	6					
307–1b	25	29	1	6	6	6	2/3			
307–3	35	3	9	10	6	6				
307–4	11	3	9	10	6	6	2/3			
312–1	20	3	1	6	6	6	6	2/3	2/3	
307–6	15	3	9	10	6	6	2/3			
308–1	5	25	1	6	2	2				
309–1	11	16	9							
309–3	19	7	8	6	6	6	2	2	2	
309–4	19	25	1	6	2	6	2	2		
310–1	32	3	9	10	2					
310–2	60	3	9	10	2					
310–3	6	3	9	10	2					
311–1	10	27	9	10	1	2/3	6	2/3	5	5
311–2/3	19	4	9	1	10	2/3	6			
311–4	24	27	1	6	2/3	5	5			
312–5										
317–7a	9	25	1	6	6	2/3				
317–7b	12	7	8	6	9	6				

1990-1991 Field Number	1990-1991 Field Acres	Crop 1990-1991 (1-27)	Tillage (Primary) Fall 90	Secondary Tillage 1990-91					
323-2	5	3	8	10	9	6			
*330-4a	20	33	1						
*330-4b	12	3	1						
330-3a	6	3	1						
330-3b	8	16	14						
330-2a	4	na	1						
330-2b	6	1	1						
330-1a	6	16	14						
330-1b	8	3	9						
328-1	4	16	14						
328-2a	14.8	3	9						
328-2b	18	3	9						
328-3/4	18.6	16	14						
	26.9	3	9						
328-5a									
328-5b	8	15	1						
328-6	13.5	15	9						
331-1	7.9	3	1						
	22	3	1	6	6				
331-3									
	10	5	1						
test									
313-2									
313-1a	5.4	17	14						
313-1b	9	16	14						
314-1	2	26	2						
314-2	14	16	14						
314-3a	14	3	5	6	6				
314-3b	14	3	9	3	6	6/3			
315-1	3	32	14	3	6	6/3			
315-13	20	3	3	7	7				
315-2	4	3	9	10	1	7			
315-3	20	3	3	7	7				
315-4	8	3	9	10	1	1	1	2/3	
315-5									
315-6a	30	4	3	7	1/2/3	4			
315-6b	10	4	9	1	1	7	7	4	
315-7	12	4	9	8	10	1/2/3	6	1/2/3	
315-8a	2	32	14						
315-8b	7	16	14						
315-9	23	9	10						
316-1	12	10	8						
316-2	5	16	4						
316-3	12	4	3	1/3	6	6	1/3		
317-1	16	3	10	5					
317-2	15	3	3	6	6	5			
317-21	48	3	9	10	9 soil fini		9	6	3
317-3	5	10	8	7					
317-6a	7	3	3	6 soil fini		6	6	3	
317-6b	4	3	9	10	6	6	3		
318-1a	22	3	3	10	9	6			
318-1b	3	3	9	10	9	6			
318-2a	14	16	14						
318-2b	4	3	10						
318-2C	9	27	1	6	6	5	5(40%)		
318-2C	8	24	1	6	6	2	5		

1990–1991 Field Number	1990–1991 Field Acres	Crop 1990–1991 (1–27)	Tillage (Primary) Fall 90	Secondary Tillage 1990–91					
318–3a	5	16	14						
318–3b	2	3	1	6	6	6	5		
318–3c	1	26	9	10	2	6	6	2	
318–4a	1.5	26	9	10	2	6	6	2	
318–4b	2.5	24	1	6	6	2	5		
318–5	8	17	14						
319–1a	1	29	1						
319–1a	9	1	9	10	2	6	6	2	5
319–1b	13	3	1						
319–1c	10	19	1						
320–1a	19	3	3	6					
320–1b/	6	3	3	6					
320–2a	12	16	14						
320–2b	22	26	3	6	6	2/3			
320–3/4	9	3	9	10	6	6	7	7	2/3
	10	24	9	6	6	6	5		
320–4b	16	3	9	10	7	7			
320–5									
	5	16	1	6	6	2/3			
320–6	11	16	14						
320–7									
322–1	6	26	1	6	6	2/3			
322–2	3	17	14						
322–6	15	3	9	10	1	1			
323–1	7	3	9	10	1	1	6		
325–2a	4	3	10						
325–2b	4	33	1						
325–3	9	3	8	6	6/2	5			
325–4	3	3	9	6	6/2	5	5		
326–31	8	18	8	2					
326–32	5	5	9	10	1	1	6/2	4	5
	21	24	1	7	7	7	5		
	28	29	1	7	7	7	5		
326–33									
326–34									
326–45	19	3	9	10	7	7			
	22	3	1	7	7				
326–46	27	3	1						
324–1	10	3	9	7	7				
324–2									
	21.5	16	14						
	8	3	1						

1990–1991 Field Number	Actual Cover 04/91 %	Est. Cover 04/91 %	Actual Cover 06/91 %	Est. Cover 06/91 %	Actual Cover 09/91 %	Est. Cover 09/91 %	Yield 1991	Units	Source	# Sa
104–6		5		5	86.3		25.5	bu/ac	ww	1
104–7		5		5	89		59.9	bu/ac	ww	1
104–8		5		5	87.3		27.2	bu/ac	ww	1
104–9		5		5	91.6		60	bu/ac	est	
102–1	20		12				na			
103–1		70		70	88.3		45	bu/ac	est	
103–2		25	12.8		89.3		1805	lb/ac	est	
131–1	20.5		5		81.4		na			
128–1	60.3		14.3		46.7		na			
104–2	10.8		10.3				30	bu/ac	ww	1
104–5	12.8		7.6		90		1600	lb/ac	est	
104–4	6.3		7.8		87		30	bu/ac	est	
131–2	7.3		3.6				na			
129–12	3.5		4.8		71.3		40.4	bu/ac	ww	1
106–1		35		70	85.6		awaiting			
106–2	15		7.5				awaiting			
107–4	8.5		4		82.7		30	bu/ac	est	
108–5a	35		7.3				na	bu/ac	est	
108–5b		5		5			na	bu/ac	est	
108–4	4.7		6.7				18	bu/ac	est	
109–1	70.3			25			21	bu/ac	est	
110–1	48.9		13.1		82.6		24	bu/ac	est	
111–1	6.7		10.5		76		27	bu/ac	est	
112–17		70		70		70	50	bu/ac	est	
132–1	34.1			35	83.3		22	bu/ac	est	
132–2C	40.3			5	84.3		20	bu/ac	est	
132–3C		70		5	89.3		40	bu/ac	est	
114–1										
114–4	93.7		79.3		95.8		28.1	bu/ac	ww	1
		70	17				24	bu/ac	ww	1
114–2										
114–3		70	13.3		85.5		33.3	bu/ac	ww	1
115–1	52.3		13.3		80		27.8	bu/ac	ww	1
115–2	6.4			5	89		18.6	bu/ac	est	
	1.8		4		85.3		0.75	ton/ac	est	
116–1										
116–2	39.3			15			na			
116–3	72		10.4				28.2	bu/ac	ww	1
116–4	55.6		9.2				28.2	bu/ac	ww	1
117–4	52.7		8.4				19.9	bu/ac	ww	1
		25		15			30	bu/ac	est	
117–3										
118–1a	13.3			5	87.3		41	bu/ac	ww	1
118–1b		15		15	85.6		na	bu/ac	ww	2
118–2	76.9		36.9				na	bu/ac	ww	2
	69.2		60				74.2	bu/ac	ww	4
119–1										
	19.3		14.8		88.7		53.6	bu/ac	ww	2
130–1										

1990–1991 Field Number	Actual Cover 04/91 %	Est. Cover 04/91 %	Actual Cover 06/91 %	Est. Cover 06/91 %	Actual Cover 09/91 %	Est. Cover 09/91 %	Yield 1991	Units	Source	# Sa
121–1	18.6			5	86		na			
	4			5	70		31.9	bu/ac	ww	2
121–2		5		5	68.8		24.9	bu/ac	ww	2
121–7		70		70	88.3		37.4	bu/ac	ww	
121–3	6.9		5.7		83.7		29.9	bu/ac	ww	1
121–6		15	6.3		91		43.1	bu/ac	ww	2
129–1	38.6		20.4				0.75	t/ac	est	
129–2	10.6		9.4		41.5		28.8	bu/ac	ww	1
122–1		70		70		70	na			
122–2	40.5		42.3		89.2		30	bu/ac	ww	1
122–3	39		50.4		87.2		52.1	bu/ac	ww	1
122–4	48		49.6		86		85.2	bu/ac	ww	2
122–5		70		5	82		3520	lb/ac	ww	
123–1	50.6		9.7		48.3		15	bu/ac	est	
124–1	45.5		23.5		86.3		1250	lb/ac	est	
125–1	3.3		2				19.2	bu/ac	ww	1
126–2		5	3.3		80.5		17.9	bu/ac	est	
126–3		70	13.2		81		17.9	bu/ac	est	
126–4a	4		0.7		55.3		na	bu/ac	est	
126–4b		5		5			na			
126–4c		70		5			na			
126–1	45.2		8.8		74		20.1	bu/ac	ww	1
127–1	51.2		31.6				30	bu/ac	ww	1
127–2	29.7		9		75.1		24	bu/ac	ww	1
127–3	33.5		46		80.3		23.7	bu/ac	ww	1
127–4	59.2		17		88.6		24.5	bu/ac	ww	1
127–5	15.7		9				66	bu/ac	ww	2
control										
201–1	3.3		13.3		86.7		60	bu/ac	est	
201–2	11.2		3.2				100	bu/ac	est	
201–3		70		70			na			
201–4		70		70			na			
201–5		70		70			na			
201–6		70		70			na			
201–7a	1.6		3.2		12.7		na			
201–7b		70		70			na			

1990–1991 Field Number	Actual Cover 04/91 %	Est. Cover 04/91 %	Actual Cover 06/91 %	Est. Cover 06/91 %	Actual Cover 09/91 %	Est. Cover 09/91 %	Yield 1991	Units	Source	# Sa
202–1		70		70			na			
203–1	7.6		12.5		94.4		29.8	bu/ac	elev	
203–3	84		10		89		95.9	bu/ac	elev	
203–4	10.7		9		88.3		98.4	bu/ac	elev	
204–1	56.9		5.6		75.4		3.27	t/ac	elev	
205–1	8		16.6		89.5		116.2	bu/ac	ww	1
205–3	8		16.6		89.3		110.1	bu/ac	ww	2
205–2	64.8		18.9		86.7		111	bu/ac	ww	
206–1	75.6		37.1		74.5		75	bu/ac	elev	
206–2	78		36.5		78		85	bu/ac	elev	
207–1C	10		15.7		90.4		109	bu/ac	elev	
207–2C	8.2		20				115	bu/ac	elev	
224–3	17.6		1.7		85		3.75	t/ac	elev	
224–2	79.6		5.7		76.7		3.75	t/ac	elev	
216–3C	51.6		20				126.4	bu/ac	ww	2
216–4C	9.3		13.7				36	bu/ac	elev	
216–5C	9.3		13.7				36	bu/ac	elev	
216–6C	8.8		8				36	bu/ac	elev	
216–6C	75			25			na			
216–7C		35	4.4		69.3		3.2	t/ac	elev	
218–11	61.5		4		88.6		36.7	bu/ac	elev	
218–12	6			5			87.5	bu/ac	elev	
218–21	5.3		9.1		79		112.2	bu/ac	elev	
218–23	14.4			5	86.8		52.8	bu/ac	ww	2
218–4C	73			70	67.4		48.1	bu/ac	ww	1
218–4C	73			70			32.4	bu/ac	ele	
218–5C	87			70			68.5	bu/ac	ww	1
218–5C		70	5.5		83		92.5	bu/ac	est	
218–6C	10.7		8.5				85	bu/ac	est	
218–7C	83.3			70			36.7	bu/ac	elev	
218–3C	37.8		17.8		94		102	bu/ac	ww	3
218–3C	10.5		10.5				79.1	bu/ac	ww	1
218–13	5.3				86.8		22.1	bu/ac	elev	
test										
207–T1	33.3			35			43.3	bu/ac	ww	1
209–1	9.5		9.5		91		120.1	bu/ac	ww	
209–2a	81		8.5				99.9	bu/ac	ww	2
209–2b	8		8.5		91.6		121.8	bu/ac	ww	2
209–3	35.6		11		88.4		105	bu/ac	est	
209–4a	68.8		67.2		92.4		60.2	bu/ac	ww	2
209–4b	68.8		67.2		86.8		97.8	bu/ac	ww	2
209–5a	78		80		96		87	bu/ac	ww	2
209–5b	81.3		73.2		95.6		36.9	bu/ac	elev	
210–1	4.9		9.3		88.3		90.7	bu/ac	ww	2
210–2	70.8		66.2		93		29.3	bu/ac	ww	2
210–3	28.5		25.8		95.8		118.8	bu/ac	ww	
210–4a	35.3		2.8		81.1		34.9	bu/ac	elev	2
210–4b	60.8			70	88.7		51.9	bu/ac	ww	2
210–5	4.3		1.6		68.5		3.5	ton/ac	elev	

1990– 1991 Field Number	Actual Cover 04/91 %	Est. Cover 04/91 %	Actual Cover 06/91 %	Est. Cover 06/91 %	Actual Cover 09/91 %	Est. Cover 09/91 %	Yield 1991	Units	Source	# Sa
212–1	58		20				20	bu/ac	est	
212–2	33.8		12.5		81		16	bu/ac	est	
212–3	64.4		28.3				15	bu/ac	est	
213–7	73		69.3				na			
213–1		70		70			na			
213–4a	17.3			70	91.3		80.8	bu/ac	ww	1
213–4b	5.3		5.3		13		na			
213–5	59			70	95.3		69.8	bu/ac	ww	2
214–1		5		5			na			
224–1	44.6		27.8		81 8		1.7	t/ac	elev	
216–11	96.8		93.2				14.4	bu/ac	elev	
216–12	20		2.4		87.3		103	bu/ac	elev	
216–1	66.3		32		78.5		107.6	bu/ac	ww	2
216–2	61.4			70	89.6		51.2	bu/ac	elev	
216–3T	51.6			25	90		126.4	bu/ac	ww	2
216–4T	9.3			5	86		33	bu/ac	elev	
216–5T	9.3			5			33	bu/ac	elev	
216–6T	8.8			5			33	bu/ac	elev	
216–7T		35	19.3		74.7		3.2	t/ac	elev	
217–1	10.3			5	89.1		60.5	bu/ac	elev	
217–2	47.6		18		74.4		3.9	t/ac	elev	
217–3		70		70			na			
218–1T	92.8		88.7		89.6		44.1	bu/ac	elev	
218–23	54.8			25	96		46.3	bu/ac	ww	1
218–24	14.4		8.8		88		33.9	bu/ac	ww	
218–25	13.3			5	86.6		23.3	bu/ac	ww	
218–25		70		25	88		19.7	bu/ac	ww	
218–26	73.2		74.3		94.8		27.8	bu/ac	ww	
218–27	82		9.1		85.3		120.5	bu/ac	elev	
218–2T	90 3		86		90.3		97.4	bu/ac	ww	4
218–3T	37.8		17.8		94		102	bu/ac	ww	
218–3T	10.5		10.5		85.3		79.1	bu/ac	ww	1
218–4T	70.8		58		99.4		48.1	bu/ac	elev	1
218–4T	70.8		64.8		90.5		32.4	bu/ac	elev	1
218–5T	87			70	96.5		68.5	bu/ac	ww	1
218–7T	83.3				77.5		36.7	bu/ac	elev	
218–13	5.3				86.8		22.1	bu/ac	elev	
219–1	8.5		5.4		84		84.1	bu/ac	elev	
219–2	94.8		69.7		89		81.4	bu/ac	elev	
219–3	35.3			70	87.7		42.5	bu/ac	elev	
219–4	72		22.5		74.8		62.5	bu/ac	elev	
219–5	53.5			70	96		63.7	bu/ac	elev	
220–1	41.6			5	6.2		na			
22C–3	50		9		83.7		15	bu/ac	est	
220–5		70		70			na			
220–4	3		1				23.3	bu/ac	elev	
221–1		70	80				78.8	bu/ac	elev	

1990-1991 Field Number	Actual Cover 04/91 %	Est. Cover 04/91 %	Actual Cover 06/91 %	Est. Cover 06/91 %	Actual Cover 09/91 %	Est. Cover 09/91 %	Yield 1991	Units	Source	# Sa
221-2	84.7			70	98.4		35.8	bu/ac	elev	
221-3-		70		70			na			
222-1		35		15			na			
222-2a		70		5			na			
222-2b		70		70			na			
control										
301-4	36		4.7				na			
302-1	4.5		3.3		35.6		2294	lb/ac	est	
302-2a	19.6		11.2				159.8	bu/ac	ww	1
302-2b	86.4		8				152.6	bu/ac	ww	1
303-1a/	0.8		2				154.5	bu/ac	ww	1
303-1c	86		7.3				162.7	bu/ac	ww	1
303-2	99.5		7.5				165	bu/ac	est	
303-3	42.8		1.3				165	bu/ac	est	
306-1	14.4		10.4		72		86.9	bu/ac	ww	2
306-2	75.6		6.8		86		123.3	bu/ac	ww	1
306-3	8.7		4		90		129.3	bu/ac	ww	1
306-4	59.3		13		87.3		142.9	bu/ac	ww	1
306-5	7.2		31.6		88.4		86	bu/ac	ww	1
307-1a	4		2				na			
307-1b	18.3			70	75.1		60.3	bu/ac	ww	1
307-1b	10.8		1		73.1		2300	lb/ac	elev	
307-3	11.4		1.3				107.3	bu/ac	ww	1
307-4	69.5		2				160.6	bu/ac	ww	1
312-1	4.8		4				172.7	bu/ac	ww	1
307-6	63		3				155.8	bu/ac	ww	1
308-1	6		4.7		70.7		64	bu/ac	ww	1
309-1		70		70			na			
309-3	33.7			70			69	bu/ac	est	
309-4	3.6		11.7		71.2		92.8	bu/ac	est	2
310-1	91		6.3		92.3		169.1	bu/ac	ww	2
310-2	91.8		6		88.3		177.5	bu/ac	ww	4
310-3	94.5		2		90.5		169.1	bu/ac	ww	1
311-1	91.3		3.6		88		146.1	bu/ac	ww	
311-2/3	92.4		7.3		82.3		51	bu/ac	ww	2
311-4	1.3		0.3				160.8	bu/ac	ww	
312-5										
317-7a	3.4		21.3				64.6	bu/ac	ww	1
317-7b	29			70	74.5		78	bu/ac	elev	

1990–1991 Field Number	Actual Cover 04/91 %	Est. Cover 04/91 %	Actual Cover 06/91 %	Est. Cover 06/91 %	Actual Cover 09/91 %	Est. Cover 09/91 %	Yield 1991	Units	Source	# Sa
323–2	24		1.3		93.3		170	bu/ac	elev	
*330–4a	5.2		0.4		48.8		50.3	bu/ac	elev	
*330–4b		5		5			na			
330–3a		5		5			na			
330–3b		70		70		70	na			
330–2a		5		5			na			
330–2b		5		5			na			
330–1a		70		70			na			
330–1b		70		5			na			
328–1		70		70		70	na			
328–2a		70		5			na			
328–2b		70		5			na			
328–3/4		70		70		70	na			
		70		5			na			
328–5a										
328–5b		5		70		70	na			
328–6		70		70		70	na			
331–1		5		5			na			
	7.6		1.1				170	bu/ac	elev	
331–3										
		5		5			3075	lb/ac	elev	
test										
313–2										
313–1a		70		70		70	na			
313–1b		70		70		70	na			
314–1	9.3		20.7		74.7		71.5	bu/ac	ww	1
314–2		70		70		70	na			
314–3a	37		7.5				184.9	bu/ac	elev	
314–3b	86.5		0				149.6	bu/ac	ww	1
315–1		70		70		70	na			
315–13	6		15.6		92.4		169.7	bu/ac	ww	1
315–2	76.7		8.7		99.3		165.4	bu/ac	ww	1
315–3	9.2		9.6		91.2		166.5	bu/ac	ww	2
315–4	100		11.3		93.3		160	bu/ac	est	
315–5										
315–6a	12		0.9		89		40.1	bu/ac	ww	2
315–6b	92.7		4.7		94.5		36.2	bu/ac	ww	1
315–7	71.2		15.5		87.6		54	bu/ac	elev	
315–8a		70		70		70	na			
315–8b		70		70		70	na			
315–9	86.7		45.7		93.7		84.4	bu/ac	ww	2
316–1		70		70	100		68.5	bu/ac	ww	1
316–2		70		70		70	na			
316–3	13		3		89		44	bu/ac	elev	
317–1	91		43.6		91.2		149	bu/ac	ww	4
317–2	17.5		13.5				127.8	bu/ac	ww	2
317–21	91.3		2		90.5		190	bu/ac	elev	
317–3	42			70	72.7		81	bu/ac	elev	
317–6a	7		0				152	bu/ac	elev	
317–6b	52.7		0		25.3		24	MT/ac	est	
318–1a	25.7		12.5		90.5		na	bu/ac	est	
318–1b		70		5			na			
318–2a		70	67.3			70	na			
318–2b		70		70			na			
318–2C	8.7		0.7		88.7		99.4	bu/ac	ww	2
318–2C	3		0.5		69.3		48.3	bu/ac	elev	

1990–1991 Field Number	Actual Cover 04/91 %	Est. Cover 04/91 %	Actual Cover 06/91 %	Est. Cover 06/91 %	Actual Cover 09/91 %	Est. Cover 09/91 %	Yield 1991	Units	Source	# Sa
318–3a		70		70		70	na			
318–3b		5	8.7		77.3		103.9	bu/ac	ww	1
318–3c	65.3		4				47.5	bu/ac	ww	1
318–4a	92		4		80		47.5	bu/ac	ww	1
318–4b	6.4		2.7		60.7		47.5	bu/ac	ww	1
318–5		70		70		70	na			
319–1a		5	1.3		36.7		37.5	bu/ac	ww	
319–1a	71.3		3.3		36.7		na			
319–1b	4.3		3				na			
319–1c		5		5	93		na			
320–1a	3.6		4.3				na			
320–1b/	7			5			na			
320–2a		70		70		70	na			
320–2b	2		16.3		92.7		57.7	bu/ac	ww	2
320–3/4	18.7		0.7				140	bu/ac	elev	
	72.7		7.3		57		3200	lb/ac	elev	
320–4b	24.4		2.8				166	bu/ac	elev	
320–5										
	2		3.3				na			
320–6		70		70			na			
320–7										
322–1	2		0.7		80		1	ton/ac	est	
322–2		70		70			na			
322–6		70	5		88.5		na			
323–1	98.7		3.3		68		na			
325–2a	68		42		71.3		na			
325–2b	1.3		1.3		46		2308	lb/ac	elev	
325–3	38		6.7				145.8	bu/ac	ww	1
325–4	100		17.3				152.5	bu/ac	ww	1
326–31	96					100	na			
326–32		70	2.7	70	24.7		54.2	bu/ac	ww	2
	19.6		7		48		2840	lb/ac	elev	
	23.6		5.3		61.7		2700	lb/ac	elev	
326–33										
326–34										
326–45	59		0		88.4		172	bu/ac	elev	
	6.8		0.7		89.3		172	bu/ac	elev	
326–46	15		0.9		88.3		164	bu/ac	elev	
324–1	42.7		0		87.3		182	bu/ac	elev	
324–2										
		70		70		70	na			
		5		5			na			

1990-1991 Field Number	ples	Other Comments	1991-1992 Field Number	1991-1992 Crop	Tillage (Primary) Fall 91	acres
			control			
104-6			104-6		7	35
104-7			104-7		8	50
104-8			104-8		7	35
104-9			104-9		8	15
102-1			102-1		1	5
103-1			103-1	3	1	40
103-2			103-2	3	1	39
131-1			131-1	3	1	49
128-1			128-1	3	1	25
			128-1			
104-2			104-2		7	44
			104-2			
104-5			104-4		1	18
104-4			104-5		1	50
131-2			131-2	3	1	50
129-12			129-12	4	5	11
106-1			106-1	3	1	7
106-2			106-2	7	7	3
107-4	1 variety		107-4	3	9	15
108-5a	18 bu/ac - not sure if for 5a or 5b		108-1	7	7	18
108-5b						
108-4			108-2	7	7	25
109-1			109-1	7	7	30
110-1	1 variety		103-4	3	1	29
111-1	1 variety		111-1	4	1	10
112-17	1st cut - alfalfa		112-17	3	1	8
132-1	1 variety		132-1	4	9	11
132-2C	1 variety		132-2	4	9	11
132-3C	1 variety		132-3	7	9	11
			132-4a	3	9	6
			132-4b	3	9	6
114-1			test			
114-4			114-1	4	10	24
			114-4	7	10	10
114-2						
114-3			114-2	4	10	18
115-1			114-3	4	10	20
115-2			115-1	7	7	18
			115-2	4	8	15
116-1			115-2	4	8	34
116-2	fallow		116-1	7	7	8
116-3			116-2	4	7	17
116-4			116-3	23	7	17
117-4			116-4	7	7	3
			117-1	7	10	12
117-3						
118-1a			117-4	4	6	16
118-1b	25 bu/ac - not sure if for 1a or 1b		118-1	4	10	27
118-2	2 varieties		118-1			
	2 varieties		118-2	4	10	9
119-1						
			119-1	4	4	3
130-1						

1990–1991 Field Number	ples	Other Comments	1991–1992 Field Number	1991–1992 Crop	Tillage (Primary) Fall 91	acres
121–1			130–1		7	28
		2 varieties	121–1	10	10	24
			121–1			
121–2		2 varieties	121–8	4	8	16.5
121–7		1 variety	121–7	3	4	32.5
121–3			121–3	4	4	24
121–6		2 varieties	121–6	4	6	24
129–1			129–1	4	6	24
129–2			129–2	7	10	24
122–1		alfalfa	122–1	15	14	10
122–2			122–2	28	10	16
			122–2			
122–3			122–3	4	10	15
122–4		2 varieties	122–4	4	10	20
122–5		1 variety	122–5	4	7	9
123–1			123–1	4	9	28
124–1			124–1	4	6	50
			124–1			
125–1			125–1	7	10	42
126–2		source – crop insurance	126–2	4	7	20
			126–2			
			126–2			
126–3		source – crop insurance	126–3	4	7	27
			126–3			
126–4a		17.9 bu/ac – not sure if for 4a, 4b, or 4c	126–4	4	7	20
126–4b		source – crop insurance				
126–4c						
126–1			126–1	4	7	30
127–1			127–1	7	10	16
127–2			127–2	3	9	52
			127–2			
			127–2			
127–3			127–3	4	10	72
127–4			127–4	4	10	42
127–5		2 varieties	127–5	4	8	21

control		control			
201–1		201–1	8	1	5
201–2		201–2	8	1	16
201–3	pasture	201–3n	1	9	25
201–4	pasture	201–3s	17	9	
201–5	pasture	201–4	17	9	20
201–6	hay	201–5	17	9	20
201–7a		201–6	1	1	23
201–7b	hay	201–7a	10	1	15

1990–1991 Field Number	ples	Other Comments
202–1	hay	
203–1		
203–3		
203–4		
204–1		
205–1		
205–3		
205–2		
206–1		
206–2		
207–1C		
207–2C		
224–3		
224–2		
216–3C	109 bu/ac using elev	
216–4C		
216–5C		
216–6C		
216–6C		
216–7C		
218–11		
218–12		
218–21		
218–23	2 varieties	
218–4C		
218–4C		
218–5C		
218–5C		
218–6C		
218–7C		
218–3C	3 varieties	
218–3C		
218–13		
test		
207–T1		
209–1		
209–2a		
209–2b		
209–3		
209–4a		
209–4b		
209–5a		
209–5b		
210–1		
210–2	2 varieties	
210–3		
210–4a		
210–4b		
210–5		

1991–1992 Field Number	1991–1992 Crop	Tillage (Primary) Fall 91	acres
201–7b	8	1	15
202–1	17	14	16
203–1	10	7	30
203–1	10	7	
203–3	3	1	15
203–4	3	1	25
204–1	2	1	45
205–1	4	1	57
205–3	4	1	33
205–2	3	1	33
206–1		1	45
206–2		1	45
207–1C	4	1	45
207–2C	4	1	30
224–3	4	5	40
224–2	4	5	15
216–3C	4	1	10
216–4C	7	8	50
216–4c	7	8	
216–4c	7	8	
216–7a	4	1	20
216–7b			
218–11	3	1	23
218–12	4	1	40
218–21	4	3	10
218–21	3	9	13
218–23	3	3	20
218–4Ca		9	2
218–4C	3	10	3
218–5C	3	10	5
218–5C	3	3	7
218–6C	4	3	4
218–7C	7	7	6
218–3C	3	6	1.5
218–3C	4	3	3.5
218–13	7	7	30
test			
207–t1	3	6	28
207–t1			
209–1	3	3	6
209–2	3	3	20
209–2			
209–3	3	10	14
209–4a	3	8	13
209–4b	4	10	7
209–5a	4	10	10
209–5b	7	10	10
210–1	4	5	14
210–2	3	10	17
210–3	4	10	26
210–4a	10	14	20
210–4b	15	10	25

1990–1991 Field Number	ples	Other Comments
212–1		
212–2		
212–3		
213–7	hay	
213–1	pasture	
213–4a		
213–4b		
213–5		
214–1		
224–1		
216–11		
216–12		
216–1		
216–2		
216–3T		
216–4T		
216–5T		
216–6T		
216–7T		
217–1		
217–2		
217–3	pasture	
218–1T		
218–23		
218–24		
218–25		
218–25		
218–26		
218–27		
218–2T	2 varieties	
218–3T		
218–3T		
218–4T		
218–4T		
218–5T		
218–7T		
218–13		
219–1		
219–2		
219–3		
219–4		
219–5		
220–1	fallow	
220–3		
220–5	pasture	
220–4		
221–1		

1991–1992 Field Number	1991–1992 Crop	Tillage (Primary) Fall 91	acres
210–5	4	10	30
212–1	7	7	7
212–2	9	9	25
212–3	7	7	11
213–7	15	14	6
213–1	17	14	8
213–4a	3	10	2.5
213–4b	3	10	2.5
213–5a	3	10	4
213–5b	3	5	18
224–1	3	9	28
224–1			
216–11	7	10	13
216–12	4	1	15
216–1	4	10	26
216–1			
216–2T	3	10	14
216–2T			
216–3t	4	1	1
216–4T	7	10	3
216–5T	3	6	3
216–6T	3	6	3
216–7T	4	10	15
216–7T	4	10	
217–1	2	9	35
217–2	4	10	40
217–3	17	14	10
218–1t	3	10	10
218–23t	3	3	8
218–24t	3	6	10
218–25	7	10	8
218–25	7	10	
218–26t	7	10	12
218–27t	3	6	18
218–2t	3	10	16
218–3ta	3	6	33
218–3tb	4	3	3
218–4T	4	10	4
218–4T	3	10	6
218–5T	3	10	5
218–5t	3	3	
218–7t	7	7	2
218–13	7	7	6
219–1	4	10	10
219–2	4	10	9
219–3	3	6	16
219–3	3	6	
219–4	4	10	4
219–5	3	6	2
220–1	7	8	16
220–1			
220–3	4	10	22
220–3	1	8	
220–5	17	14	10
220–4	7	10	13

1990-1991 Field Number	ples	Other Comments
221-2		
221-3-	hay	
222-1		
222-2a		
222-2b		
control		
301-4		
302-1		
302-2a		
302-2b		
303-1a/		
303-1c		
303-2		
303-3		
306-1		
306-2		
306-3		
306-4		
306-5		
307-1a	alfalfa	
307-1b		
307-1b		
307-3		
307-4		
312-1		
307-6		
308-1		
309-1	hay	
309-3		
309-4	2 varieties of oats	
310-1		
310-2		
310-3		
311-1		
311-2/3		
311-4		
312-5		
317-7a		
317-7b		

1991-1992 Field Number	1991-1992 Crop	Tillage (Primary) Fall 91	acres
221-1	4	10	17
221-2	4	10	13
221-3-	16	14	9
221-3-6			
221-3-6			
222-1			5
222-2			9
control			
301-4	3	1	7
302-1	3	1	15
302-2A		1	19
302-2A			
302-2B		1	12
303-1A	3	1	18
303-1A	3		
303-1C	3	1	7
303-2	3	1	12
303-3	3	9	35
306-1	3	1	18
306-2	9	1	25
306-3	9	1	1/2/3
306-4	9	1	1/2/3
306-5	3	9	19
307-1a	16	14	10
307-1b	16	9	31
307-1b	7	6	25
307-3	3	1	35
307-4	3	1	11
307-5	3	1	20
307-6	3	1	15
308-1	16	14	5
309-1	16	14	11
309-3	26	1	19
309-4	3	1	19
309-4			
310-1	3	9	32
310-2	3	9	60
310-3	3	9	6
311-1	3	9	10
311-1			
311-2/3	3	1	19
311-2/3			
311-4a	3 turnips	9	10
311-4b	19	9	14
312-5	3	1	9

1990- 1991 Field Number	ples	Other Comments
323-2		
*330-4a		
*330-4b		
330-3a		
330-3b	hay	
330-2a		
330-2b		
330-1a	hay	
330-1b		
328-1	hay	
328-2a		
328-2b		
328-3/4	hay	
328-5a		
328-5b	alfalfa	
328-6	alfalfa	
331-1		
331-3		
test		
313-2		
313-1a	pasture	
313-1b	hay	
314-1		
314-2	hay	
314-3a		
314-3b		
315-1	hay	
315-13		
315-2		
315-3		
315-4		
315-5		
315-6a	2 varieties	
315-6b		
315-7		
315-8a		
315-8b	hay	
315-9	2 varieties	
316-1		
316-2	hay	
316-3		
317-1	3 varieties	
317-2		
317-21		
317-3		
317-6a		
317-6b		
318-1a	178 bu/ac – not sure if for 6a or 6b	
318-1b		
318-2a	hay	
318-2b		
318-2C	1 smpl undrsd/1 smpl not	
318-2C		

1991- 1992 Field Number	1991- 1992 Crop	Tillage (Primary) Fall 91	acres
317-7a	3	3	12
317-7b	3	3	5
323-2	3	5	20
330-4	3	1	12
330-4	25		6
330-3a	3	1	12
330-3b	16	9	
330-2a	25	1	6
330-2b	3	1	6
330-1a	3	9	8
330-1b	25	1	4
328-1	3	9	14.8
328-2a	3	9	18
328-2b	3	1	18.6
328-3	16	1	26.9
328-4	25		
328-5a	16	14	8
328-5b	16	14	13.5
328-6	16	1	7.9
331-1	3	1	22
331-3	3	5	10
test			
313-2	16	14	5.4
313-1a	3	5,6	9
313-1b	16	14	2
314-1	3	5,6	14
314-2	3	9	14
314-3a	3	3	14
314-3b	32	14	3
315-1	4	3	20
315-13	4	9	4
315-2	4	3	20
315-3	3	9	8
315-4a	4	10	16
315-4b	7	10	14
315-5	7	10	10
315-6	7	10	14
315-7	16	14	7
315-8a	3	6	23
315-8b	3	9	12
315-9	16	14	5
316-1	3	10	12
316-2	3	3	16
316-3	4	3	15
317-1	3	6	48
317-2	3	9	5
317-21	3	3	7
317-3	3	3	4
317-6	24	3	25
318-1	17	14	18
318-2a	3	9	9

1990-1991 Field Number	ples	Other Comments	1991-1992 Field Number	1991-1992 Crop	Tillage (Primary) Fall 91	acres
318-3a	hay		318-2b	3	6	8
318-3b			318-6		14	5
318-3c			318-2c	3	9	2
318-4a			318-3a	3	9	1
318-4b			318-3b	3	9	1.5
318-5	pasture		318-3c	3	6	2.5
319-1a			318-4a	7	10	8
319-1a			318-4b	7	10	1
319-1b	Pioneer Research Stn		318-5		6	9
319-1c	Pioneer Research Stn		319-1a	3	3	13
320-1a	Pioneer Research Stn		319-1a	3	3	10
320-1b/	Pioneer Research Stn		319-1b	19	3	19
320-2a	hay		319-1c	31	3	6
320-2b			320-1a	16	14	12
320-3/4			320-1b/	16	9	22
			320-2a	9	9	9
320-4b			320-2b	9	1	10
320-5			320-3/4	3	9	16
	hay					
320-6	hay		320-4b	16	14	5
320-7			320-5	29	14	11
322-1			320-5			
322-2	pasture		320-6	16	9	6
322-6			320-7		14	3
323-1			322-1	29	14	15
325-2a			322-2	3	9	7
325-2b			322-6	9	1	4
325-3			323-1	3	5	4
325-4			325-2A		9	9
326-31			325-2B		9	3
326-32			325-3	3	9	8
			325-4		8	5
			326-31		6	21
			326-32	7	6	28
326-33						
326-34						
326-45						
			326-33	3	9	19
326-46			326-34	3	9	22
			326-45		1	27
324-1			326-45			
324-2			326-41	3	1	5
	hay		326-42	3	9	5
			324-1	3	9	21.5
			324-2	3	1	8

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1991–1992 Field Number	Secondary Tillage 1991–92			Actual Cover 10/91 %	Est. Cover 10/91 %	Actual Cover 04/92 %	Est. Cover 04/92 %	Actual Cover 06/92 %	Est. Cover 06/92 %
control									
104–6				20.6		6		5.7	
104–7				21.5		13.4		6	
104–8				21.8		10.7		4.3	
104–9				21		12		7.7	
102–1				4		2.8		1.3	
103–1	6			7.5		7.3		5.3	
103–2	6	6		11.5		7.7		8	
131–1	1	6		25.3			5		
128–1	6/6	1		23.7		10.3		4	
128–1									
104–2				49					
104–2									
104–4				22.9		10.6		8	
104–5						6.7		2.3	
131–2	1	6					5		5
129–12	6	6		26.7		10.4		6.3	
106–1	6/6/6	6/6		1.3		1.2		1	
106–2				12			70		70
107–4	1	1				49.6		9.7	
108–1	1	1		9.5			70		70
108–2	1	1		26.8			70		70
109–1				34.7			70		70
103–4	6	6		12.7			5		5
111–1				21.6		8		6.3	
112–17	6	6				19.3		10	
132–1	1	1	1			78.4		15.3	
132–2	1	1	1			78.4		15.3	
132–3	1	1				60.8			70
132–4a	10					57.2			5
132–4b	1	1				57.2		8.7	
test									
114–1						59.7		47.6	
114–4				23.3			70		70
114–2						51.3		35	
114–3						44.3		24	
115–1				24.8			70		70
115–2	1	6	6	42.3		42		18	
115–2	1	6	6			20.3		11.3	
116–1				2.7			70		70
116–2	6	7/7/7		27.3		12.8		3.6	
116–3				23.7		11.6		4.3	
116–4				25.3			70		70
117–1							70		70
117–4	6			35.1		18.3		0.7	
118–1						60		72	
118–1									
118–2						73.8		48.7	
119–1	1			39.6		30.4		21.6	

1991–1992 Field Number	Secondary Tillage 1991–92			Actual Cover 10/91 %	Est. Cover 10/91 %	Actual Cover 04/92 %	Est. Cover 04/92 %	Actual Cover 06/92 %	Est. Cover 06/92 %
130–1				35.7					
121–1							70		70
121–1									
121–8	6	6		14.6		14.9		7.1	
121–7	7	7		20.9		2.5		4.3	
121–3	7	7		19.3		7.3		8	
121–6	7	7		42.9		28		10	
129–1	6			35		20.3		10.3	
129–2				41.5			70		70
122–1							70		70
122–2						60		46	
122–2									
122–3						61.7		52.6	
122–4						65.3		59.6	
122–5	8	8		20.7		10.8		8.6	
123–1	1	6	6			17.7		8.7	
124–1	6			36.5		30		9.4	
124–1									
125–1				35.4			70		70
126–2	1	1		16		5.7		3.7	
126–2									
126–2									
126–3	1	1		18		11		8.7	
126–3									
126–4	1	1		18.9		6		6.7	
126–1	1	1		19.3		6.7		2.7	
127–1				64.8			70		70
127–2	1	1				50.5		6.4	
127–2									
127–2									
127–3						58.8		49.8	
127–4						65.3		55.4	
127–5				49.3		44		46.8	
control									
201–1						3.5			4
201–2						5.5			4
201–3n							70		15
201–3s							70		70
201–4							70	10.4	
201–5							70	10.4	
201–6						7.1		1.4	
201–7a						10.3		4.3	

1991–1992 Field Number	Secondary Tillage 1991–92	Actual Cover 10/91 %	Est. Cover 10/91 %	Actual Cover 04/92 %	Est. Cover 04/92 %	Actual Cover 06/92 %	Est. Cover 06/92 %
201–7b				5.8		4.3	
202–1					70		70
203–1				78.2			70
203–1				78.2			70
203–3				13.6			5
203–4				10.5			5
204–1				3.6		2.4	
205–1				12.2		8	
205–3				6		8	
205–2				4.3		7.1	
206–1				2.8		4	
206–2				3.8		3.4	
207–1C				7.2		9	
207–2C				9.8		9.2	
224–3				13.6		5.4	
224–2				19.3		6	
216–3C				8.7			5
216–4C				17.3			70
216–4c				17.3			70
216–4c				17.3			70
216–7a					5	2.3	
216–7b							
218–11				2.9		1	
218–12				6.2		5.3	
218–21				14.4		14.5	
218–21				65.3			5
218–23				15.3		3.5	
218–4C				70.7		59.5	
218–4C				63.3		62.5	
218–5C					70	74	
218–5C					5	7.3	
218–6C					5	11	
218–7C				12			70
218–3C				33		38	
218–3C				13.3		13.5	
218–13				19.3			70
test							
207–t1				23.3		4.6	
207–t1							
209–1				12.5		4	
209–2				9.3		4	
209–2							
209–3				78.6		68.3	
209–4a				72		72.7	
209–4b				82		76.3	
209–5a				83.7		76.3	
209–5b				92.3			70
210–1				49.8		18.8	
210–2				76.6			70
210–3				77.6		59.5	
210–4a					70		70
210–4b				37.6			70

1991–1992 Field Number	Secondary Tillage 1991–92	Actual Cover 10/91 %	Est. Cover 10/91 %	Actual Cover 04/92 %	Est. Cover 04/92 %	Actual Cover 06/92 %	Est. Cover 06/92 %
210–5				50.9		34.7	
212–1				34			70
212–2				32.7		1.7	
212–3				49			70
213–7					70		70
213–1					70		70
213–4a				86.7			70
213–4b				9.3			5
213–5a				84			70
213–5b					70		35
224–1				49		2.3	
224–1							
216–11				71.1			
216–12				8		3.2	
216–1				52.2		47.4	
216–1							
216–2T				69.1		64.5	
216–2T							
216–3t				8.7		4	
216–4T				15.3			70
216–5T				12		2.2	
216–6T				12		2.2	
216–7T				34		17	
216–7T							
217–1				96.8			15
217–2				52.8		61.6	
217–3					70		70
218–1t				73.3		70.4	
218–23t				15.3		10.5	
218–24t				26.7		10	
218–25				47.3			70
218–25					35		70
218–26t				61			70
218–27t				54.8		27.3	
218–2t				68		74.4	
218–3ta				33		38	
218–3tb				13.3		13.5	
218–4T				70.7		59.5	
218–4T				63.3		62.5	
218–5T				71.3		74	
218–5t				14.7			5
218–7t				12			70
218–13				19.3			70
219–1				59.3		58	
219–2				44.7		71	
219–3				28.8		21	
219–3				28.8		39	
219–4				41.3		66	
219–5				44.7		68.7	
220–1				17			70
220–1							
220–3				71		24.9	
220–3				1		1	
220–5					70		70
220–4				16.7			70

1991–1992 Field Number	Secondary Tillage 1991–92			Actual Cover 10/91 %	Est. Cover 10/91 %	Actual Cover 04/92 %	Est. Cover 04/92 %	Actual Cover 06/92 %	Est. Cover 06/92 %
221–1						80.4		76.3	
221–2						69.5		76.4	
221–3–							70		70
221–3–									
221–3–									
222–1							5		5
222–2							5		5
control									
301–4						2.7		4.7	
302–1						6		2	
302–2A	7					12			0
302–2A	7								
302–2B	7					10.8			0
303–1A						3.3		8.4	
303–1A									
303–1C						5		8.4	
303–2						6.5		9.6	
303–3						62.5		3.8	
306–1	10	7				4			5
306–2	7	1/2/3				7.2		10	
306–3	7	1/2/3				8.7		10.7	
306–4	7	1/2/3				6.4		7.6	
306–5	10	7	1			70		5.3	
307–1a						52.7			70
307–1b						52.3			70
307–1b						24			70
307–3						3.3		11.4	
307–4						2		8	
307–5						4.4		8	
307–6						6.7		8	
308–1						72			70
309–1						69.3			70
309–3	7/2	2				2.4		0	
309–4	7					7.5		0	
309–4									
310–1	10	2				83.7		4	
310–2	6	1				78		35.4	
310–3	6	1				78.7		34	
311–1	10	7				79		3.5	
311–1									
311–2/3	10	7				5.2		5	
311–2/3									
311–4a	10	7				76		3.5	
311–4b	10	7	7(3x)			76			5
312–5	1					0.7		2.7	

1991–1992 Field Number	Secondary Tillage 1991–92		Actual Cover 10/91 %	Est. Cover 10/91 %	Actual Cover 04/92 %	Est. Cover 04/92 %	Actual Cover 06/92 %	Est. Cover 06/92 %
317–7a					5.2		0.8	
317–7b					12		7.5	
323–2					11.6		0.7	
330–4						5		
330–4								70
330–3a						5		5
330–3b								
330–2a						5		70
330–2b						5		5
330–1a						70		
330–1b						5		70
328–1						70		
328–2a						70		
328–2b						5		5
328–3						5		70
328–4								
328–5a						70		70
328–5b						70		70
328–6						5		70
331–1					4.5		13.6	
331–3					17.3		7	
test								
313–2						70		70
313–1a	6				19.3		22.4	
313–1b						70		70
314–1	7				19		4.5	
314–2	10	7			89.6		4	
314–3a	6	1			6		4	
314–3b						70		70
315–1	6				13.2		11.2	
315–13	10				78.8		14	
315–2	6				9.6		9	
315–3	10	1			83		8.7	
315–4a					67.5			70
315–4b					67.5		35	
315–5					62.7			70
315–6					46.5			70
315–7					88.7			70
315–8a	6				24.4		10.5	
315–8b	10	1			99.3		10.8	
315–9					55.5			70
316–1					64		23	
316–2					16		12	
316–3					16.5		10.8	
317–1					34		26	
317–2					86		3.3	
317–21					6		12	
317–3					12.7		2.7	
317–6					8		11.7	
318–1						70		70
318–2a	10				90.7		2.5	

1991–1992 Field Number	Secondary Tillage 1991–92		Actual Cover 10/91 %	Est. Cover 10/91 %	Actual Cover 04/92 %	Est. Cover 04/92 %	Actual Cover 06/92 %	Est. Cover 06/92 %
318–2b					18		5.5	
318–6	10					70		5
318–2c					94.7		5.5	
318–3a					94		5	
318–3b					94		5	
318–3c					12.7		5	
318–4a					40			70
318–4b					40			70
318–5					18			5
319–1a	6				8.7		0.4	
319–1a	6				8.7		7.5	
319–1b	6				11.3		4	
319–1c	6				11.3		5	
320–1a					93.5			70
320–1b/					83.3			70
320–2a	7				74.7		16	
320–2b	7				3		4	
320–3/4					65.2		9.7	
320–4b					65.2			70
320–5	10				74.7		3.5	
320–5								
320–6					71.3			70
320–7						70		70
322–1	10				64		6.4	
322–2	10				76.7		12.7	
322–6					2		6	
323–1						5	2	
325–2A	6/2	1			64			25
325–2B	6/2	1			64			25
325–3	10	1			71.3		4.7	
325–4	6	1			20		0.5	
326–31					9.3			5
326–32	1				33.7			70
326–33	10				87.8		6.8	
326–34	10				88.7		6.8	
326–45					6		2	
326–45								
326–41					10		2	
326–42	10				98		2	
324–1						70		
324–2						5		5

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